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(*Continued on Inside Back Cover*)

THE JOURNAL OF
EDUCATIONAL PSYCHOLOGY

Volume 41 April, 1950 Number 4

# TRAITS OF PERSONALITY AND THEIR INTER-CORRELATIONS AS SHOWN IN BIOGRAPHIES[1]

EDWARD L. THORNDIKE

Professor Emeritus, Teachers College, Columbia University

I have studied one or more biographies of each of the men listed below, including thirty-four writers, twenty-three statesmen, lawyers and labor leaders, fifteen business men, including two who were also inventors, nine military men, five scientists and/or inventors, three medical men, one clergyman and one monarch.

Writers: Barrie, Bennett, Browning, Burns, Byron, Carlyle, Coleridge, Cooper, Dickens, Havelock Ellis, Eugene Field, Fielding, Anatole France, Gissing, Goethe, Thomas Hardy, Hawthorne, Housman, Irving, Samuel Johnson, Lamb, Landor, Melville, Poe, Scott, Lincoln Steffens, Swinburne, Tennyson, Thackeray, Thoreau, Mark Twain, Wells, Whitman, Wordsworth.

Statesmen, lawyers and labor leaders: Bismarck, Bradlaugh, Brandeis, Carlisle Cleveland, Coolidge, Debs, Disraeli, Franklin, Alexander Hamilton, Harding, Hay, House, Andrew Jackson, Jefferson, Lincoln, Lloyd George, Ramsay Macdonald, McKinley, Tom Reed, T. Roosevelt, Carl Schurz, Webster.

Business men: John Jacob Astor, Carnegie, Jay Cooke, Eastman, Frick, Gary, Hanna, E. H. Harriman, J. J. Hill, Cyrus H. McCormick, J. Pierpont Morgan, Leland Stanford, Cornelius Vanderbilt, Wanamaker, Woolworth.

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[1] The study reported here occupied my father during the last year of his life. He was working on it up to the time of his death. Part of the manuscript was certainly written during the week before he died and it is, as the reader will see, incomplete. It is published here without addition or change except for one or two explanatory footnotes. It represents his final legacy to psychology as an empirical, experimental science. [Robert L. Thorndike]

Military men: Grant, Haig, Hindenburg, Kitchener, Lee, Napoleon, Sherman, Washington, Wellington.

Scientists, inventors, and medical men: Darwin, Edison, Lord Kelvin, C. H. Mayo, W. J. Mayo, Newton, Osler, Pasteur.

Henry Ward Beecher, William II of Germany.

In computing the correlations I have included also ratings of nine persons well known to me, making one hundred in all.

I have rated each person for each of the traits listed below on a scale running −3, −2½, −2, −1½, −1, −½, 0, +½, +1, +1½, +2, +2½, +3 in terms of standard deviations from the median of the white males of the United States. The traits were chosen to include those reported on by Cyril Burt, some of those reported on by the author, and the 'factors' regarded as important by the Guilfords. I found myself unable to rate these men for Cattell's 'factors,' perhaps because I did not fully understand them. I did not try to use his thirty-five trait clusters because of the labor involved. Probably I should have made the effort.

Traits chosen especially for comparison with Burt: general emotionality (1), curiosity (4), worry (8), fear (6), anger (7), joy (15), sadness (9), sociability (11), sexual proclivity (17). The numbers here and later identify the traits in the correlation table (Table 1). Traits chosen especially for comparison with Thorndike: intelligence (2), craving for approval (10), dominance (12), liking for conflict (13), shyness (28), display (29), and the degree of liking for each of the following: things (30), people (31), animals (32), plants (33), children (41), words (34), reading (35), art, music, and beauty (37), bodily exercise (36), talking (42), sedentary games (45), responsibility (40), system (38), neatness (39), such indulgences as eating, drinking and smoking (43).

Traits chosen especially for comparison with Guilford factors: rathymia (19), objectivity (20), coöperativeness (21), general activity (22), inferiority complex (23), N of Guilford or nervousness (24), agreeableness (25), depression (26).

Other traits: motor ability (3), sensitiveness (5), affection (18), unselfishness (16), cruelty (14), sanity (27), relative strength of the likings for female society and for male society (44).

For special reasons I have made estimates also of (46) parental wealth at the time the man was age zero to fifteen, (47) degree to which the father or male head of the household indulged the boy, and (48) degree to which the mother or female head of the household indulged him.

When the household had no male head, I have arbitrarily entered the degree of paternal indulgence as at the median of that of the United States population.

I did not expect to discover much of value from my ratings when I began the work and my expectations grew less as it progressed. Modern biographers of the realistic school do try to include events that show the man's total personality as well as his career as a specialist, and an instructive volume could be composed of cases of trait $x$ in person $y$, evidenced by $y$'s actual behavior. But they leave many gaps.

The validity of the ratings consequently varies from very high as for sex in Byron, unselfishness in Pasteur, talking in Coleridge, agreeableness in Jay Cooke, or shyness in Theodore Roosevelt, to very low as when the only basis for rating a person in the trait is that the person was probably ordinary with respect to it because the biography gives no facts or opinions concerning that trait. This is not a safe assumption. If I had not used only men for whom recent and realistic biographies containing fairly detailed personal histories were available, many more of the ratings would have been little better than guesses. Taking them at their face value we have the intercorrelations of Table 1.

Any one of these correlations can be explored further by using only those men in whom the two traits in question have fairly dependable ratings. I intended to do this, but I cannot. My ratings were often made without written notes of the evidence supporting them. At the time it seemed sure that I would remember what it was, and my memories (at age seventy-five) are failing rapidly. Nor have I the strength to review the written notes I made when reading the biographies. So I leave the intercorrelations of Table 1 for what they may be worth, and append the ratings of the ninety-one biographies for—variables which are at least mostly better than mere chance for the use of any psychologist making similar studies. I hope the weakness of my study will not discourage them.[2]

Anybody can adduce many reasons why this way of studying

[2] Apparently my father intended to estimate reliabilities of the ratings for the different traits by re-rating the individuals after a period of time. Some work sheets on this aspect of the study were among his papers. However, it was not completed, and so it is impossible to select particular traits to be reported. The complete table of ratings for the ninety-one individuals and forty-eight traits is appended to this report. [R. L. T.]

TABLE 1.—INTERCORRELATIONS AMONG 48 PERSONALITY VARIABLES

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. General emotionality | | −11 | −02 | −04 | 29 | 02 | 12 | 00 |
| 2. Intelligence | −11 | | 20 | 14 | 36 | 07 | 06 | 05 |
| 3. Motor ability | −02 | 20 | | 19 | 00 | −16 | 06 | −11 |
| 4. Curiosity (things and people) | −04 | 14 | 19 | | 06 | −04 | −04 | −21 |
| 5. Sensitiveness | 29 | 36 | 00 | 06 | | 29 | 12 | 31 |
| 6. Fear | 02 | 07 | −16 | −04 | 29 | | −14 | 41 |
| 7. Anger | 12 | 06 | 06 | −04 | 12 | −14 | | 08 |
| 8. Worry | 00 | 05 | −11 | −21 | 31 | 41 | 08 | |
| 9. Sadness | 01 | −09 | −21 | −31 | 35 | 19 | 13 | 41 |
| 10. Craving for approval | 11 | 02 | 08 | −06 | 21 | 38 | 13 | 28 |
| 11. Sociability | 23 | −09 | 11 | 36 | −25 | −17 | −06 | −44 |
| 12. Dominance | 08 | 07 | 17 | 01 | −15 | −35 | 68 | −12 |
| 13. Liking for conflict | 09 | 03 | 04 | 05 | −15 | −35 | 57 | −17 |
| 14. Cruelty | −08 | −10 | 01 | −05 | −09 | 02 | 47 | 07 |
| 15. Joy | 24 | −15 | −03 | 30 | −10 | −18 | −19 | −36 |
| 16. Unselfishness | −19 | 16 | 06 | 22 | −14 | −19 | −44 | −09 |
| 17. Sexual proclivity | 34 | 06 | −04 | −02 | 05 | −05 | 18 | −06 |
| 18. Affection | 25 | −14 | −02 | 19 | 04 | −15 | −29 | −20 |
| 19. Rathymia | 35 | −22 | 01 | 13 | 16 | 13 | 09 | −04 |
| 20. Objectivity | −54 | 11 | 15 | 27 | −32 | −26 | 25 | −10 |
| 21. Coöperativeness | −34 | 11 | 07 | 15 | −36 | −27 | −41 | −24 |
| 22. General activity | −07 | 28 | 35 | 31 | −14 | −27 | 02 | −26 |
| 23. Inferiority complex | 31 | −24 | −15 | −32 | 27 | 25 | −02 | 26 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24. Nervousness | 36 | 08 | −15 | −06 | 53 | 46 | 19 | 47 |
| 25. Agreeableness | 30 | 03 | 11 | 29 | −02 | −01 | −38 | −27 |
| 26. Depression | 26 | −07 | −30 | −23 | 48 | 48 | 17 | 53 |
| 27. Sanity | −43 | 30 | 15 | 27 | −26 | −22 | −17 | −26 |
| 28. Shyness | −09 | 05 | 02 | −30 | 38 | 27 | −10 | 52 |
| 29. Liking for display | 45 | −11 | −08 | −02 | 17 | 17 | 27 | −03 |
| 30. Liking for things | 00 | 12 | 32 | 52 | 18 | −07 | −05 | −14 |
| 31. Liking for people | 18 | −08 | 07 | 33 | −26 | −19 | −13 | −43 |
| 32. Liking for animals | 16 | 00 | 22 | 03 | −07 | −12 | −03 | −09 |
| 33. Liking for plants | 18 | 07 | 15 | 10 | 15 | 00 | 01 | −07 |
| 34. Liking for words | 24 | 37 | −14 | 03 | 56 | 39 | 00 | 15 |
| 35. Liking for reading | 12 | 55 | −13 | 11 | 52 | 27 | −07 | 22 |
| 36. Liking for bodily exercise | 04 | 23 | 42 | 04 | −02 | −02 | 09 | −12 |
| 37. Liking for art, music, beauty | 17 | 20 | 02 | 01 | 31 | 16 | −15 | −09 |
| 38. Liking for system | −31 | 25 | 15 | 11 | −03 | −29 | −15 | −10 |
| 39. Liking for neatness | −15 | 21 | 27 | −05 | 02 | −14 | −12 | −12 |
| 40. Liking for responsibility | −25 | 15 | 11 | 18 | −25 | −45 | −07 | −25 |
| 41. Liking for children | 10 | 07 | 24 | −01 | −11 | −28 | −05 | −07 |
| 42. Liking to talk | 41 | 12 | −19 | 15 | 20 | 14 | 00 | −15 |
| 43. Liking for eating, drinking, etc. | 16 | −09 | −08 | −04 | 04 | 19 | 10 | −08 |
| 44. Preference of female over male society | 16 | −02 | 15 | −08 | 39 | 02 | 08 | 08 |
| 45. Liking for sedentary games | −10 | 12 | 04 | 14 | −09 | −07 | −20 | −12 |
| 46. Parental wealth | −02 | 04 | 22 | −11 | 02 | 05 | 17 | −15 |
| 47. Paternal indulgence | 09 | 20 | −08 | 07 | 18 | 07 | −12 | −18 |
| 48. Maternal indulgence | −05 | 20 | 05 | 13 | 28 | 09 | 01 | 01 |

TABLE 1.—(*Continued*)

| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 01 | 11 | 23 | 08 | 09 | −08 | 24 | −19 | 34 | 25 | 35 | −54 | −34 | −07 |
| 2. | −09 | 02 | −09 | 07 | 03 | −10 | −15 | 16 | 06 | −14 | −22 | 11 | 11 | 28 |
| 3. | −21 | 08 | 11 | 17 | 04 | 01 | −03 | 06 | −04 | −02 | 01 | 15 | 07 | 35 |
| 4. | −31 | −06 | 36 | 01 | 05 | −05 | 30 | 22 | −02 | 19 | 13 | 27 | 15 | 31 |
| 5. | 35 | 21 | −25 | −15 | −15 | −09 | −10 | −14 | 05 | 04 | 16 | −32 | −36 | −14 |
| 6. | 19 | 38 | −17 | −35 | −35 | 02 | −18 | −19 | −05 | −15 | 13 | −26 | −27 | −27 |
| 7. | 13 | 13 | −06 | 68 | 57 | 47 | −19 | −44 | 18 | −29 | 09 | −25 | −41 | 02 |
| 8. | 41 | 28 | −44 | −12 | −17 | 07 | −36 | −09 | −06 | −20 | −04 | −10 | −24 | −26 |
| 9. | | 02 | −48 | −16 | −16 | 07 | −27 | −12 | −05 | −05 | −12 | −26 | −23 | −37 |
| 10. | 02 | | 05 | 14 | 01 | 18 | −16 | −26 | −08 | −12 | 23 | −27 | −30 | −17 |
| 11. | −48 | 05 | | 16 | 22 | 01 | 54 | 05 | 32 | 21 | −32 | −01 | 24 | 08 |
| 12. | −16 | 14 | 16 | | 72 | 52 | −18 | −33 | 20 | −28 | 08 | −10 | −21 | 14 |
| 13. | −16 | 01 | 22 | 72 | | 50 | −02 | −19 | 22 | −15 | 07 | −03 | −19 | 17 |
| 14. | 07 | 18 | 01 | 52 | 50 | | −23 | −50 | 14 | −52 | 17 | −27 | −45 | −22 |
| 15. | −27 | −16 | 54 | −18 | −02 | −23 | | 20 | 11 | 36 | 27 | 06 | 20 | −04 |
| 16. | −12 | −26 | 05 | −33 | −19 | −50 | 20 | | −32 | 48 | −33 | 60 | 59 | 37 |
| 17. | −05 | −08 | 32 | 20 | 22 | 14 | 11 | −32 | | 07 | 28 | −28 | −16 | −11 |
| 18. | −05 | −12 | 21 | −28 | −15 | −52 | 36 | 48 | 07 | | 02 | 16 | 32 | 15 |
| 19. | −12 | 23 | 32 | 08 | 07 | 17 | 27 | −33 | 28 | 02 | | −43 | −39 | −28 |
| 20. | −26 | −27 | −01 | −10 | −03 | −27 | 06 | 60 | −28 | 16 | −43 | | 67 | 44 |
| 21. | −23 | −30 | 24 | −21 | −19 | −45 | 20 | 59 | −16 | 32 | −39 | 67 | | 39 |
| 22. | −37 | −17 | 08 | 14 | 17 | −22 | −04 | 37 | −11 | 15 | −28 | 44 | 39 | |
| 23. | 42 | 13 | −20 | −19 | −20 | 17 | −02 | −29 | 13 | −06 | 28 | −37 | −42 | −43 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24. | 50 | 30 | −25 | −02 | −14 | 17 | −17 | −32 | 15 | −09 | 26 | −49 | −56 | −24 |
| 25. | −36 | −08 | 56 | −26 | −20 | −39 | 51 | 24 | 13 | 22 | 22 | 05 | 29 | 01 |
| 26. | 60 | 29 | −34 | −13 | −18 | 18 | −25 | −41 | 17 | −14 | 18 | −57 | −53 | −52 |
| 27. | −43 | −20 | 15 | −04 | −01 | −31 | 12 | 55 | −25 | 12 | −39 | 59 | 57 | 44 |
| 28. | 44 | 15 | −64 | −38 | −40 | −13 | −37 | 10 | −30 | −05 | −24 | 02 | −12 | −11 |
| 29. | −09 | 36 | 25 | 32 | 26 | 28 | 06 | −57 | 42 | −14 | 39 | −54 | −50 | −24 |
| 30. | −04 | −12 | −06 | −02 | −14 | −22 | 08 | 15 | −09 | 27 | 02 | 18 | 10 | 21 |
| 31. | −40 | −08 | 70 | 07 | 17 | −16 | 56 | 23 | 12 | 41 | 23 | 09 | 29 | 13 |
| 32. | −11 | −03 | 15 | −03 | 00 | −26 | 29 | 24 | −15 | 33 | −03 | 07 | 22 | −02 |
| 33. | 02 | −03 | 04 | 05 | 05 | −09 | 05 | 03 | −07 | 18 | −01 | −01 | 01 | 10 |
| 34. | 09 | 37 | 05 | −07 | −08 | 03 | 04 | −19 | 21 | 02 | 28 | −36 | −28 | −21 |
| 35. | 03 | 00 | −12 | −17 | −01 | 01 | −04 | 03 | 05 | −11 | 05 | −18 | −19 | −04 |
| 36. | −22 | 04 | 11 | 09 | 11 | −10 | 08 | 10 | −12 | 03 | −23 | 20 | 10 | 30 |
| 37. | −03 | −02 | 05 | −19 | −19 | −20 | 09 | −10 | 11 | 18 | −01 | −17 | 01 | 01 |
| 38. | −11 | −24 | −13 | −06 | −04 | −29 | −17 | 43 | −28 | 10 | −62 | 50 | 52 | 45 |
| 39. | −12 | −15 | −04 | −11 | −09 | −29 | −18 | 28 | −19 | 03 | −48 | 27 | 39 | 35 |
| 40. | −21 | −33 | 14 | 17 | 24 | −28 | 05 | 45 | −15 | 27 | −47 | 60 | 60 | 53 |
| 41. | −16 | −03 | 17 | 06 | 05 | −21 | 25 | 32 | −05 | 28 | 02 | 19 | 22 | 22 |
| 42. | −03 | 18 | 45 | 03 | 11 | −02 | 38 | −13 | 22 | 15 | 24 | −34 | −18 | −14 |
| 43. | −16 | 22 | 31 | 15 | 08 | 38 | 12 | −45 | 34 | −21 | 49 | −39 | −41 | −41 |
| 44. | 20 | 13 | −08 | 00 | −02 | 14 | −05 | −31 | 26 | −01 | 21 | −19 | −35 | −18 |
| 45. | −25 | 07 | 33 | −11 | 04 | −16 | 25 | 30 | −04 | 09 | −03 | 26 | 28 | 11 |
| 46. | −19 | 04 | −06 | 19 | 00 | 16 | −13 | −21 | 04 | −23 | 01 | −13 | −11 | −07 |
| 47. | −11 | −10 | −02 | −11 | 09 | −09 | 11 | 09 | −04 | 09 | −02 | −05 | 14 | 08 |
| 48. | 10 | −05 | −09 | −21 | 02 | −13 | −06 | −05 | −09 | 06 | 01 | −03 | 01 | 05 |

TABLE 1.—(*Continued*)

| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 31 | 36 | 30 | 26 | −43 | −09 | 45 | 00 | 18 | 16 | 18 | 24 | 12 | 04 |
| 2. | −24 | 08 | 03 | −07 | 30 | 05 | −11 | 12 | −08 | 00 | 07 | 37 | 55 | 23 |
| 3. | −15 | −15 | 11 | −30 | 15 | 02 | −08 | 32 | 07 | 22 | 15 | −14 | −13 | 42 |
| 4. | −32 | −06 | 29 | −23 | 27 | −30 | −02 | 52 | 33 | 03 | 10 | 03 | 11 | 04 |
| 5. | 27 | 53 | −02 | 48 | −26 | 38 | 17 | 18 | −26 | −07 | 15 | 56 | 52 | −02 |
| 6. | 25 | 46 | −01 | 48 | −22 | 27 | 17 | −07 | −19 | −12 | 00 | 39 | 27 | −21 |
| 7. | −02 | 19 | −38 | 17 | −17 | −10 | 27 | −05 | −13 | −03 | 01 | 00 | −07 | 09 |
| 8. | 26 | 47 | −27 | 53 | −26 | 52 | −03 | −14 | −43 | −09 | −07 | 15 | 22 | −12 |
| 9. | 42 | 50 | −36 | 60 | −43 | 44 | −09 | −04 | −40 | −11 | 02 | 09 | 03 | −22 |
| 10. | 13 | 30 | −08 | 29 | −20 | 15 | 36 | −12 | −08 | −03 | −03 | 37 | 00 | 04 |
| 11. | −20 | −25 | 56 | −34 | 15 | −64 | 25 | −06 | 70 | 15 | 04 | 05 | −12 | 11 |
| 12. | −19 | −02 | −26 | −13 | −04 | −38 | 32 | −02 | 07 | −03 | 05 | −07 | −17 | 09 |
| 13. | −20 | −14 | −20 | −18 | −01 | −40 | 26 | −14 | 17 | 00 | 05 | −08 | −01 | 11 |
| 14. | 17 | 17 | −39 | 18 | −31 | −13 | 28 | −22 | −16 | −26 | −09 | 03 | 01 | −10 |
| 15. | −02 | −17 | 51 | −25 | 12 | −37 | 06 | 08 | 56 | 29 | 05 | 04 | −04 | 08 |
| 16. | −29 | −32 | 24 | −41 | 55 | 10 | −57 | 15 | 23 | 24 | 03 | −19 | 03 | 10 |
| 17. | 13 | 15 | 13 | 17 | −25 | −30 | 42 | −09 | 12 | −15 | −07 | 21 | 05 | −12 |
| 18. | −06 | −09 | 22 | −14 | 12 | −05 | −14 | 27 | 41 | 33 | 18 | 02 | −11 | 03 |
| 19. | 28 | 26 | 22 | 18 | −39 | −24 | 39 | 02 | 23 | −03 | −01 | 28 | 05 | −23 |
| 20. | −37 | −49 | 05 | −57 | 59 | 02 | −54 | 18 | 09 | 07 | −01 | −36 | −18 | 20 |
| 21. | −42 | −56 | 29 | −53 | 57 | −12 | −50 | 10 | 29 | 22 | 01 | −28 | −19 | 10 |
| 22. | −43 | −24 | 01 | −52 | 44 | −11 | −24 | 21 | 13 | −02 | 10 | −21 | −04 | 30 |
| 23. | | 48 | −03 | 57 | −62 | 38 | 20 | −21 | −24 | −10 | −09 | 20 | 06 | −19 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24. | 48 | | −16 | 73 | −51 | 29 | 34 | −02 | −22 | −21 | −05 | 48 | 31 | −22 |
| 25. | −03 | −16 | | −21 | 13 | −30 | 08 | 09 | 58 | 22 | −03 | 12 | 05 | 12 |
| 26. | 57 | 73 | −21 | | −63 | 35 | 27 | −11 | −30 | −27 | −16 | 40 | 25 | −31 |
| 27. | −62 | −51 | 13 | −63 | | −05 | −50 | 15 | 25 | 16 | −01 | −18 | 00 | 24 |
| 28. | 38 | 29 | −30 | 35 | −05 | | −27 | −02 | −54 | −14 | −11 | 07 | 12 | 05 |
| 29. | 20 | 34 | 08 | 27 | −50 | −27 | | −06 | 16 | −10 | −03 | 29 | 04 | −16 |
| 30. | −21 | −02 | 09 | −11 | 15 | −02 | −06 | | 12 | 07 | 22 | −04 | −05 | 05 |
| 31. | −24 | −22 | 58 | −30 | 25 | −54 | 16 | 12 | | 23 | 10 | 03 | −09 | 12 |
| 32. | −10 | −21 | 22 | −27 | 16 | −14 | −10 | 07 | 23 | | 12 | −09 | −07 | 30 |
| 33. | −09 | −05 | −03 | −16 | −01 | −11 | −03 | 22 | 10 | 12 | | 05 | −08 | 22 |
| 34. | 20 | 48 | 12 | 40 | −18 | 07 | 29 | −04 | 03 | −09 | 05 | | 60 | −10 |
| 35. | 06 | 31 | 05 | 25 | 00 | 12 | 04 | −05 | −09 | −07 | −08 | 60 | | 02 |
| 36. | −19 | −22 | 12 | −31 | 24 | 05 | −16 | 05 | 12 | 30 | 22 | −10 | 02 | |
| 37. | −02 | 09 | 13 | 06 | −05 | 04 | 22 | 09 | 13 | 09 | 25 | 26 | 22 | 10 |
| 38. | −42 | −32 | −06 | −32 | 47 | 06 | −43 | 16 | 04 | 11 | 10 | −24 | 00 | 30 |
| 39. | −22 | −28 | 12 | −22 | 31 | 17 | −33 | −01 | −02 | 05 | 06 | −22 | −05 | 41 |
| 40. | −51 | −39 | 04 | −52 | 53 | −22 | −38 | 15 | 26 | 10 | 17 | −22 | −16 | 22 |
| 41. | −11 | −23 | 32 | −33 | 22 | −12 | −21 | 08 | 31 | 38 | 09 | −02 | −14 | 24 |
| 42. | 06 | 29 | 29 | 13 | −11 | −35 | 43 | −08 | 38 | 00 | 06 | 57 | 36 | −08 |
| 43. | 13 | 19 | 00 | 13 | −27 | −24 | 54 | −19 | 10 | −01 | −10 | 28 | 06 | −16 |
| 44. | 24 | 33 | −15 | 25 | −26 | 11 | 22 | 00 | −13 | −06 | 16 | 27 | 02 | −02 |
| 45. | −26 | −28 | 24 | −34 | 28 | −17 | −11 | 03 | 24 | 13 | −03 | 04 | 05 | 15 |
| 46. | −18 | −07 | −03 | −09 | 08 | −11 | 08 | 03 | −14 | 15 | 11 | −04 | −14 | 12 |
| 47. | −17 | −05 | 13 | −13 | 21 | −04 | −06 | 17 | 01 | 25 | 16 | 09 | 23 | 04 |
| 48. | −15 | 04 | 00 | 00 | 09 | 18 | −10 | 25 | −05 | 02 | 08 | 15 | 15 | 00 |

TABLE 1.—(*Continued*)

| | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 17 | −31 | −15 | −25 | 10 | 41 | 16 | 16 | −10 | −02 | 09 | −05 |
| 2. | 20 | 25 | 21 | 15 | 07 | 12 | −09 | −02 | 12 | 04 | 20 | 20 |
| 3. | 02 | 15 | 27 | 11 | 24 | −19 | −08 | 15 | 04 | 22 | −08 | 05 |
| 4. | 01 | 11 | −05 | 18 | −01 | 15 | −04 | −08 | 14 | −11 | 07 | 13 |
| 5. | 31 | −03 | 02 | −25 | −11 | 20 | 04 | 39 | −09 | 02 | 18 | 28 |
| 6. | 16 | −29 | −14 | −45 | −28 | 14 | 19 | 02 | −07 | 05 | 07 | 09 |
| 7. | −15 | −15 | −12 | −07 | −05 | 00 | 10 | 08 | −20 | 17 | −12 | 01 |
| 8. | −09 | −10 | −12 | −25 | −07 | −15 | −08 | 08 | −12 | −15 | −18 | 01 |
| 9. | −03 | −11 | −12 | −21 | −16 | −03 | −16 | 20 | −25 | −19 | −11 | 10 |
| 10. | −02 | −24 | −15 | −33 | −03 | 18 | 22 | 13 | 07 | 04 | −10 | −05 |
| 11. | 05 | −13 | −04 | 14 | 17 | 45 | 31 | −08 | 33 | −06 | −02 | −09 |
| 12. | −19 | −06 | −11 | 17 | 06 | 03 | 15 | 00 | −11 | 19 | −11 | −21 |
| 13. | −19 | −04 | −09 | 24 | 05 | 11 | 08 | −02 | 04 | 00 | 09 | 02 |
| 14. | −20 | −29 | −29 | −28 | −21 | −02 | 38 | 14 | −16 | 16 | −09 | −13 |
| 15. | 09 | −17 | −18 | 05 | 25 | 38 | 12 | −05 | 25 | −13 | 11 | −06 |
| 16. | −10 | 43 | 28 | 45 | 32 | −13 | −45 | −31 | 30 | −21 | 09 | −05 |
| 17. | 11 | −28 | −19 | −15 | −05 | 22 | 34 | 26 | −04 | 04 | −04 | −09 |
| 18. | 18 | 10 | 03 | 27 | 28 | 15 | −21 | −01 | 09 | −23 | 09 | 06 |
| 19. | −01 | −62 | −48 | −47 | 02 | 24 | 49 | 21 | −03 | 01 | −02 | 01 |
| 20. | −17 | 50 | 27 | 60 | 19 | −34 | −39 | −19 | 26 | −13 | −05 | −03 |
| 21. | 01 | 52 | 39 | 60 | 22 | −18 | −41 | −35 | 28 | −11 | 14 | 01 |
| 22. | 01 | 45 | 35 | 53 | 22 | −14 | −41 | −18 | 11 | −07 | 08 | 05 |
| 23. | −02 | −42 | −22 | −51 | −11 | 06 | 13 | 24 | −26 | −18 | −17 | −15 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24. | 09 | −32 | −28 | −39 | −23 | 29 | 19 | 33 | −28 | −07 | −05 | 04 |
| 25. | 13 | −06 | 12 | 04 | 32 | 29 | 00 | −15 | 24 | −03 | 13 | 00 |
| 26. | 06 | −32 | −22 | −52 | −33 | 13 | 13 | 25 | −34 | −09 | −13 | 00 |
| 27. | −05 | 47 | 31 | 53 | 22 | −11 | −27 | −26 | 28 | 08 | 21 | 09 |
| 28. | 04 | 06 | 17 | −22 | −12 | −35 | −24 | 11 | −17 | −11 | −04 | 18 |
| 29. | 22 | −43 | −33 | −38 | −21 | 43 | 54 | 22 | −11 | 08 | −06 | −10 |
| 30. | 09 | 16 | −01 | 15 | 08 | −08 | −19 | 00 | 03 | 03 | 17 | 25 |
| 31. | 13 | 04 | −02 | 26 | 31 | 38 | 10 | −13 | 24 | −14 | 01 | −05 |
| 32. | 09 | 11 | 05 | 10 | 38 | 00 | −01 | −06 | 13 | 15 | 25 | 02 |
| 33. | 25 | 10 | 06 | 17 | 09 | 06 | −10 | 16 | −03 | 11 | 16 | 08 |
| 34. | 26 | −24 | −22 | −22 | −02 | 57 | 28 | 27 | 04 | −04 | 09 | 15 |
| 35. | 22 | 00 | −05 | −16 | −14 | 36 | 06 | 02 | 05 | −14 | 23 | 15 |
| 36. | 10 | 30 | 41 | 22 | 24 | −08 | −16 | −02 | 15 | 12 | 04 | 00 |
| 37. | | 11 | 12 | 00 | −08 | 12 | 12 | 31 | −12 | 15 | 21 | 24 |
| 38. | 11 | | 66 | 64 | 07 | −30 | −48 | −14 | 10 | 09 | 11 | 08 |
| 39. | 12 | 66 | | 46 | 05 | −28 | −46 | −08 | −03 | 18 | −03 | 02 |
| 40. | 00 | 64 | 46 | | 30 | −14 | −45 | −19 | 17 | −08 | 02 | 01 |
| 41. | −08 | 07 | 05 | 30 | | −06 | −22 | −03 | 21 | −07 | −03 | −08 |
| 42. | 12 | −30 | −28 | −14 | −06 | | 32 | 10 | 13 | −16 | 07 | 07 |
| 43. | 12 | −48 | −46 | −45 | −22 | 32 | | 32 | 15 | 16 | −01 | −10 |
| 44. | 31 | −14 | −08 | −19 | −03 | 10 | 32 | | −12 | 13 | −07 | 10 |
| 45. | −12 | 10 | −03 | 17 | 21 | 13 | 15 | −12 | | −16 | 18 | −02 |
| 46. | 15 | 09 | 18 | −08 | −07 | −16 | 16 | 13 | −16 | | 15 | −15 |
| 47. | 21 | 11 | −03 | 02 | −03 | 07 | −01 | −07 | 18 | 15 | | 44 |
| 48. | 24 | 08 | 02 | 01 | −08 | 07 | −10 | 10 | −02 | −15 | 44 | |

the problems of personality is defective, but it is at least different from the ways hitherto taken and has the merits of using life histories available to all students of behavior. Facts could be adduced to show that the methods used by Burt, the Guilfords, and Cattell are defective also. There is in fact no royal road to dependable inventories of personalities especially after early childhood. I now think that the most promising practicable way is for each of fifty or more psychologists to rate ten or more adults intimately known to him on each of an agreed upon list of traits on a scale representing the total United States white adult population. Some foundation should then pay to have two sets of intercorrelations computed for each of the fifty or more sets of measurements, one using the alleged divergences from the United States means, the other using the divergences from the actual means of each psychologist's group. The former can be combined into an average intercorrelation table (after zeta transformations) whose values are unduly raised by the fifty psychologists' errors in estimating the United States averages and variabilities. The latter can be combined into a second average intercorrelation table whose values are unduly lowered by restricted range. Taken together these two tables would, however, be far better than all that we now have on the intercorrelations of fear, anger, dominance, pugnacity, sociability, display, shyness, etc., etc. in adults.

Because the correlations of Table 1 are in part due to the large proportions of (1) writers, (2) statesmen, and (3) business men, and because there are group differences especially between the writers and others, I give in Table 2 the means for the different groups. The group differences are less than popular psychology supposes to be the case and there is always much overlapping.

I call attention to certain matters in Table 1.

It gives some support to Burt's belief that something that may be called general emotionality exists and that it is a characteristic of juvenile offenders. In our data it correlates −.11 with intellect, −.19 with unselfishness, −.54 with objectivity, −.34 with coöperativeness, −.43 with sanity, −.31 with system, −.15 with neatness, and −.25 with responsibility. It has positive correlations of .30 or more with sexual proclivity, rathymia, inferiority, N, display, and liking to talk (but also with agreeableness).

TABLE 2.*—THE MEANS OF THE GROUPS SPECIFIED IN EACH VARIABLE OF TABLE 1

| | 34 Writers | 23 Lawyers Statesmen, etc. | 15 Business Men | 9 Military Men | 6 Men of Science |
|---|---|---|---|---|---|
| 1. General emotionality | 6.9 | 5.9 | 5.7 | 4.5 | 6.6 |
| 2. Intelligence | 11.0 | 11.4 | 11.1 | 10.4 | 12.0 |
| 3. Motor skill | 7.7 | 7.7 | 8.7 | 7.9 | 9.2 |
| 4. Curiosity (things and people) | 13.9 | 13.7 | 13.9 | 12.6 | 17.7 |
| 5. Sensitiveness | 10.0 | 8.4 | 6.7 | 6.6 | 9.0 |
| 6. Fear | 7.0 | 4.9 | 5.0 | 3.7 | 6.3 |
| 7. Anger | 6.8 | 6.7 | 6.1 | 6.6 | 6.0 |
| 8. Worry | 6.1 | 4.9 | 5.0 | 5.0 | 5.3 |
| 9. Sadness | 6.4 | 6.4 | 4.9 | 6.2 | 6.0 |
| 10. Craving for approval (short scale) | 5.2 | 4.1 | 3.5 | 4.9 | 4.0 |
| 11. Sociability | 7.4 | 8.1 | 8.4 | 6.2 | 6.8 |
| 12. Dominance | 8.2 | 9.4 | 9.0 | 9.6 | 6.8 |
| 13. Liking for conflict | 6.5 | 7.7 | 7.0 | 6.1 | 4.8 |
| 14. Cruelty | 5.8 | 4.8 | 4.9 | 4.4 | 3.7 |
| 15. Joy | 7.4 | 7.6 | 8.0 | 6.1 | 7.8 |
| 16. Unselfishness | 6.0 | 7.8 | 7.9 | 8.0 | 8.7 |
| 17. Sexual proclivity | 7.2 | 6.9 | 6.9 | 4.7 | 5.7 |
| 18. Affection | 7.9 | 8.2 | 8.1 | 8.1 | 8.0 |

TABLE 2.*—(*Continued*)

| | 34 Writers | 23 Lawyers Statesmen, etc. | 15 Business Men | 9 Military Men | 6 Men of Science |
|---|---|---|---|---|---|
| 19. Rathymia (short scale) | 5.1 | 3.0 | 2.7 | 1.8 | 3.3 |
| 20. Objectivity | 6.6 | 9.2 | 9.5 | 10.1 | 9.0 |
| 21. Coöperativeness | 6.3 | 9.2 | 9.7 | 9.7 | 9.8 |
| 22. General activity | 7.7 | 9.6 | 10.5 | 9.6 | 11.3 |
| 23. Inferiority (short scale) | 4.8 | 3.9 | 3.4 | 3.7 | 2.7 |
| 24. N of Guilford | 9.2 | 7.0 | 6.4 | 5.7 | 7.7 |
| 25. Agreeableness | 8.6 | 9.1 | 9.3 | 7.4 | 9.5 |
| 26. Depression | 7.4 | 4.7 | 3.5 | 4.6 | 5.0 |
| 27. Sanity | 7.7 | 9.8 | 10.0 | 9.2 | 10.0 |
| 28. Shyness | 6.2 | 4.9 | 4.5 | 5.6 | 5.3 |
| 29. Display | 8.5 | 6.6 | 7.1 | 4.9 | 5.0 |
| 30. Liking for things | 6.8 | 6.7 | 7.5 | 6.8 | 10.8 |
| 31. Liking for people | 7.5 | 8.0 | 8.8 | 6.7 | 7.3 |
| 32. Liking for animals | 6.7 | 6.5 | 6.7 | 7.1 | 6.8 |
| 33. Liking for plants | 6.8 | 6.5 | 6.5 | 6.4 | 5.8 |
| 34. Liking for words | 9.9 | 8.5 | 6.4 | 6.3 | 8.0 |
| 35. Liking for reading | 10.3 | 9.9 | 7.7 | 6.6 | 9.5 |
| 36. Liking for bodily exercise | 6.6 | 6.8 | 7.5 | 7.2 | 5.3 |

| | | | | | |
|---|---|---|---|---|---|
| 37. Liking for art, music, and beauty | 11.9 | 9.6 | 11.7 | 9.3 | 10.3 |
| 38. Liking for system | 6.5 | 8.1 | 8.2 | 8.9 | 8.7 |
| 39. Liking for neatness | 6.6 | 7.7 | 7.8 | 7.9 | 6.7 |
| 40. Liking for responsibility | 6.3 | 9.6 | 9.7 | 9.8 | 9.2 |
| 41. Liking for children | 6.4 | 7.2 | 7.5 | 7.7 | 7.0 |
| 42. Liking to talk | 8.1 | 8.3 | 6.5 | 5.7 | 6.3 |
| 43. Liking for self-indulgence | 9.3 | 6.9 | 6.8 | 5.2 | 5.3 |
| 44. Preference for women's society | 6.4 | 4.3 | 4.3 | 5.1 | 3.0 |
| 45. Liking for sedentary games | 6.2 | 7.3 | 7.0 | 5.7 | 6.7 |
| 46. Family wealth | 9.2 | 8.0 | 8.3 | 10.0 | 9.7 |
| 47. Paternal indulgence | 7.7 | 7.6 | 7.7 | 6.8 | 8.3 |
| 48. Maternal indulgence | 8.3 | 7.7 | 8.0 | 6.3 | 9.0 |

* The scores on which these means are based had been converted so as to yield all positive integral values. Except as noted below, the hypothetical "median of the white males of the United States" would be represented by 7.0. In five cases the scales were either cruder because of difficulty in rating or finer because of combination of sub-scales. These variables, with the value corresponding to the population zero point, are:

| | |
|---|---|
| 4. Curiosity | 12.0 |
| 10. Craving for approval | 3.0 |
| 19. Rathymia | 5.0 |
| 23. Inferiority | 5.0 |
| 37. Liking for art, music and beauty | 10.0 |

## APPENDIX: Ratings of 91 Biographees on 48 Attributes

| Person Rated | Attribute Rated | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Browning | 7 | 9 | 11 | 10 | 13 | 7 | 9 | 5 | 5 |
| 2. Carlyle | 7 | 9 | 5 | 12 | 11 | 7 | 11 | 9 | 9 |
| 3. Wordsworth | 7 | 7 | 5 | 12 | 13 | 9 | 7 | 9 | 7 |
| 4. Lamb | 9 | 7 | 5 | 14 | 13 | 7 | 3 | 7 | 5 |
| 5. Hardy | 5 | 9 | 11 | 16 | 13 | 7 | 5 | 7 | 5 |
| 6. Scott | 7 | 8 | 9 | 16 | 11 | 3 | 11 | 3 | 4 |
| 7. Thackeray | 7 | 7 | 7 | 14 | 10 | 7 | 7 | 5 | 5 |
| 8. Wells | 5 | 9 | 7 | 17 | 11 | 7 | 7 | 7 | 5 |
| 9. Samuel Johnson | 3 | 9 | 2 | 16 | 7 | 7 | 9 | 7 | 7 |
| 10. Gissing | 9 | 7 | 5 | 9 | 10 | 9 | 7 | 7 | 7 |
| 11. Bennett | 3 | 7 | 10 | 17 | 7 | 9 | 7 | 5 | 5 |
| 12. Dickens | 9 | 7 | 9 | 17 | 9 | 7 | 7 | 5 | 3 |
| 13. Hawthorne | 7 | 7 | 7 | 12 | 11 | 7 | 7 | 9 | 9 |
| 14. Anatole France | 3 | 6 | 7 | 13 | 11 | 10 | 5 | 5 | 9 |
| 15. Washington Irving | 3 | 5 | 7 | 14 | 9 | 7 | 3 | 7 | 5 |
| 16. Poe | 9 | 6 | 9 | 13 | 11 | 9 | 9 | 7 | 5 |
| 17. Mark Twain | 7 | 5 | 7 | 19 | 9 | 7 | 9 | 7 | 7 |
| 18. Goethe | 5 | 9 | 10 | 16 | 11 | 7 | 5 | 3 | 5 |
| 19. Fielding | 7 | 7 | 5 | 16 | 7 | 5 | 5 | 3 | 3 |
| 20. J. F. Cooper | 5 | 5 | 7 | 13 | 9 | 5 | 7 | 5 | 7 |
| 21. Burns | 7 | 6 | 7 | 16 | 9 | 5 | 9 | 7 | 9 |
| 22. Whitman | 7 | 6 | 5 | 13 | 7 | 5 | 3 | 3 | 4 |
| 23. Tennyson | 7 | 7 | 7 | 9 | 12 | 7 | 4 | 7 | 9 |
| 24. Swinburne | 12 | 7 | 7 | 12 | 13 | 3 | 11 | 7 | 7 |
| 25. Thoreau | 7 | 7 | 10 | 14 | 10 | 8 | 8 | 7 | 7 |
| 26. Coleridge | 13 | 7 | 7 | 14 | 9 | 11 | 3 | 7 | 7 |
| 27. Barrie | 9 | 6 | 11 | 12 | 9 | 5 | 7 | 7 | 7 |
| 28. Havelock Ellis | 3 | 6 | 5 | 14 | 9 | 10 | 3 | 8 | 7 |
| 29. Byron | 11 | 7 | 9 | 12 | 11 | 5 | 10 | 5 | 9 |
| 30. Housman | 3 | 9 | 7 | 12 | 11 | 9 | 7 | 9 | 10 |
| 31. Melville | 8 | 6 | 7 | 16 | 9 | 7 | 7 | 7 | 7 |
| 32. Landor | 9 | 9 | 11 | 12 | 10 | 9 | 11 | 7 | 7 |
| 33. Eugene Field | 7 | 5 | 11 | 14 | 7 | 7 | 3 | 3 | 7 |
| 34. Steffens | 7 | 6 | 7 | 16 | 8 | 5 | 5 | 3 | 3 |
| 35. Webster | 5 | 7 | 7 | 12 | 7 | 7 | 7 | 3 | 5 |
| 36. Bismarck | 5 | 7 | 10 | 12 | 9 | 5 | 12 | 5 | 7 |
| 37. Alexander Hamilton | 5 | 9 | 7 | 14 | 11 | 3 | 9 | 5 | 5 |
| 38. Cleveland | 3 | 5 | 7 | 15 | 7 | 2 | 7 | 5 | 5 |
| 39. Carl Schurz | 5 | 9 | 9 | 10 | 9 | 3 | 7 | 3 | 5 |
| 40. Coolidge | 2 | 6 | 7 | 13 | 7 | 5 | 7 | 7 | 5 |
| 41. T. Jefferson | 7 | 9 | 11 | 20 | 11 | 5 | 3 | 5 | 5 |
| 42. A. Jackson | 9 | 6 | 11 | 16 | 7 | 3 | 11 | 5 | 3 |
| 43. Disraeli | 7 | 8 | 7 | 12 | 9 | 5 | 5 | 3 | 5 |
| 44. Franklin | 3 | 9 | 11 | 20 | 11 | 5 | 5 | 3 | 3 |
| 45. T. Roosevelt | 9 | 8 | 11 | 15 | 7 | 4 | 9 | 5 | 3 |

APPENDIX.—(*Continued.*)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 46. Lincoln | 5 | 7 | 9 | 10 | 9 | 9 | 5 | 8 | 11 |
| 47. McKinley | 7 | 7 | 7 | 10 | 7 | 5 | 5 | 7 | 7 |
| 48. Harding | 5 | 5 | 7 | 15 | 5 | 7 | 5 | 3 | 5 |
| 49. Hay | 7 | 7 | 4 | 10 | 11 | 10 | 7 | 9 | 9 |
| 50. Carlisle | 3 | 7 | 4 | 12 | 7 | 7 | 3 | 7 | 7 |
| 51. Brandeis | 7 | 9 | 9 | 16 | 9 | 7 | 5 | 5 | 5 |
| 52. Bradlaugh | 7 | 8 | 7 | 12 | 7 | 3 | 7 | 5 | 7 |
| 53. Debs | 10 | 7 | 7 | 14 | 9 | 2 | 3 | 3 | 9 |
| 54. Macdonald | 7 | 8 | 11 | 15 | 11 | 3 | 9 | 7 | 7 |
| 55. Lloyd George | 9 | 8 | 4 | 16 | 9 | 4 | 9 | 3 | 5 |
| 56. Tom Reed | 4 | 7 | 4 | 16 | 7 | 5 | 7 | 3 | 5 |
| 57. House | 5 | 6 | 7 | 10 | 7 | 3 | 7 | 3 | 7 |
| 58. Frick | 3 | 8 | 9 | 12 | 7 | 4 | 4 | 5 | 7 |
| 59. J. J. Hill | 7 | 7 | 10 | 17 | 7 | 3 | 7 | 5 | 5 |
| 60. Hanna | 7 | 6 | 9 | 14 | 7 | 5 | 7 | 5 | 3 |
| 61. Stanford | 5 | 7 | 7 | 16 | 7 | 7 | 7 | 5 | 7 |
| 62. Morgan | 5 | 8 | 7 | 10 | 7 | 3 | 11 | 7 | 5 |
| 63. Carnegie | 8 | 9 | 9 | 14 | 9 | 5 | 3 | 5 | 3 |
| 64. E. H. Harriman | 3 | 8 | 9 | 13 | 7 | 4 | 7 | 5 | 7 |
| 65. Gary | 4 | 9 | 11 | 12 | 7 | 7 | 5 | 3 | 5 |
| 66. J. J. Astor | 3 | 7 | 9 | 13 | 5 | 4 | 7 | 7 | 5 |
| 67. C. Vanderbilt | 3 | 6 | 11 | 15 | 5 | 2 | 9 | 5 | 5 |
| 68. Jay Cooke | 9 | 7 | 9 | 14 | 7 | 5 | 3 | 3 | 3 |
| 69. Wanamaker | 9 | 7 | 5 | 16 | 7 | 7 | 3 | 3 | 3 |
| 70. Woolworth | 7 | 5 | 5 | 12 | 5 | 7 | 5 | 7 | 5 |
| 71. Cyrus McCormick | 7 | 5 | 9 | 14 | 7 | 7 | 9 | 5 | 5 |
| 72. Eastman | 5 | 2 | 11 | 16 | 7 | 5 | 5 | 5 | 5 |
| 73. Napoleon | 7 | 8 | 7 | 17 | 9 | 3 | 9 | 5 | 7 |
| 74. R. E. Lee | 3 | 8 | 9 | 14 | 9 | 3 | 3 | 3 | 7 |
| 75. Sherman | 9 | 7 | 9 | 12 | 10 | 4 | 9 | 9 | 8 |
| 76. Wellington | 5 | 6 | 7 | 12 | 4 | 3 | 5 | 5 | 5 |
| 77. Kitchener | 4 | 6 | 7 | 12 | 5 | 3 | 7 | 7 | 7 |
| 78. Grant | 4 | 5 | 7 | 8 | 7 | 4 | 3 | 7 | 7 |
| 79. Hindenburg | 1 | 6 | 7 | 12 | 3 | 3 | 5 | 1 | 5 |
| 80. Washington | 3 | 7 | 9 | 18 | 7 | 5 | 7 | 5 | 3 |
| 81. Haig | 5 | 5 | 9 | 8 | 5 | 5 | 11 | 3 | 7 |
| 82. Newton | 1 | 9 | 11 | 18 | 11 | 9 | 9 | 7 | 7 |
| 83. Pasteur | 7 | 8 | 10 | 18 | 11 | 7 | 5 | 7 | 7 |
| 84. Osler | 7 | 8 | 9 | 18 | 7 | 5 | 5 | 3 | 3 |
| 85. Kelvin | 7 | 9 | 11 | 16 | 7 | 5 | 5 | 3 | 7 |
| 86. Darwin | 7 | 7 | 7 | 18 | 11 | 7 | 3 | 7 | 7 |
| 87. Edison | 7 | 7 | 7 | 18 | 7 | 5 | 9 | 5 | 5 |
| 88. Beecher | 12 | 5 | 9 | 9 | 7 | 4 | 5 | 7 | 5 |
| 89. William II | 10 | 6 | 7 | 13 | 7 | 9 | 9 | 3 | 4 |
| 90. W. H. Mayo | 5 | 7 | 7 | 12 | 9 | 7 | 9 | 5 | 7 |
| 91. C. J. Mayo | 7 | 6 | 11 | 16 | 5 | 7 | 5 | 5 | 5 |

APPENDIX.—(*Continued.*)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 6 | 4 | 9 | 7 | 5 | 7 | 5 | 5 | 9 | 1 | 5 | 7 | 11 |
| 2. | 7 | 4 | 11 | 8 | 7 | 3 | 3 | 5 | 5 | 1 | 3 | 3 | 9 |
| 3. | 4 | 4 | 7 | 5 | 3 | 5 | 7 | 9 | 10 | 3 | 9 | 7 | 9 |
| 4. | 6 | 7 | 3 | 3 | 3 | 11 | 11 | 3 | 11 | 5 | 11 | 9 | 7 |
| 5. | 5 | 7 | 8 | 4 | 3 | 7 | 7 | 7 | 9 | 5 | 11 | 8 | 9 |
| 6. | 3 | 10 | 10 | 10 | 4 | 9 | 9 | 7 | 7 | 7 | 7 | 5 | 11 |
| 7. | 5 | 10 | 7 | 7 | 3 | 9 | 8 | 7 | 8 | 9 | 8 | 7 | 7 |
| 8. | 4 | 9 | 8 | 7 | 5 | 7 | 9 | 10 | 9 | 5 | 9 | 7 | 9 |
| 9. | 6 | 7 | 11 | 9 | 7 | 7 | 7 | 9 | 7 | 3 | 7 | 7 | 3 |
| 10. | 3 | 3 | 5 | 3 | 5 | 3 | 5 | 11 | 9 | 1 | 3 | 5 | 10 |
| 11. | 6 | 10 | 10 | 10 | 7 | 7 | 5 | 8 | 7 | 1 | 11 | 7 | 9 |
| 12. | 6 | 8 | 10 | 5 | 3 | 11 | 9 | 7 | 9 | 5 | 7 | 7 | 11 |
| 13. | 5 | 3 | 5 | 3 | 3 | 5 | 7 | 5 | 9 | 3 | 5 | 5 | 3 |
| 14. | 4 | 6 | 4 | 3 | 7 | 5 | 3 | 7 | 5 | 3 | 7 | 5 | 5 |
| 15. | 5 | 9 | 4 | 4 | 3 | 13 | 3 | 7 | 9 | 7 | 7 | 9 | 4 |
| 16. | 6 | 8 | 12 | 9 | 7 | 3 | 1 | 9 | 7 | 7 | 3 | 3 | 7 |
| 17. | 7 | 11 | 9 | 6 | 7 | 11 | 7 | 5 | 7 | 7 | 5 | 7 | 7 |
| 18. | 6 | 8 | 10 | 6 | 7 | 7 | 5 | 9 | 7 | 1 | 9 | 9 | 12 |
| 19. | 5 | 11 | 7 | 7 | 7 | 9 | 7 | 10 | 9 | 9 | 9 | 9 | 9 |
| 20. | 7 | 9 | 10 | 11 | 7 | 7 | 4 | 5 | 9 | 3 | 4 | 7 | 8 |
| 21. | 5 | 11 | 9 | 9 | 9 | 8 | 9 | 9 | 9 | 7 | 7 | 9 | 9 |
| 22. | 5 | 9 | 7 | 6 | 3 | 9 | 7 | 9 | 10 | 9 | 7 | 7 | 9 |
| 23. | 7 | 5 | 7 | 3 | 5 | 5 | 7 | 3 | 7 | 1 | 6 | 7 | 3 |
| 24. | 5 | 7 | 11 | 10 | 9 | 9 | 3 | 9 | 4 | 7 | 4 | 3 | 7 |
| 25. | 5 | 4 | 8 | 8 | 7 | 7 | 5 | 3 | 7 | 7 | 7 | 3 | 9 |
| 26. | 5 | 9 | 7 | 5 | 4 | 7 | 3 | 10 | 7 | 9 | 1 | 5 | 5 |
| 27. | 6 | 7 | 11 | 7 | 7 | 7 | 9 | 7 | 9 | 9 | 7 | 5 | 9 |
| 28. | 3 | 4 | 3 | 3 | 3 | 7 | 9 | 5 | 9 | 5 | 10 | 9 | 11 |
| 29. | 5 | 7 | 10 | 7 | 11 | 7 | 1 | 13 | 7 | 5 | 3 | 3 | 5 |
| 30. | 7 | 5 | 9 | 7 | 9 | 3 | 7 | 3 | 5 | 1 | 7 | 7 | 9 |
| 31. | 3 | 7 | 7 | 5 | 7 | 9 | 5 | 5 | 7 | 5 | 5 | 5 | 7 |
| 32. | 7 | 7 | 13 | 9 | 7 | 9 | 3 | 11 | 7 | 9 | 3 | 3 | 5 |
| 33. | 3 | 9 | 7 | 5 | 9 | 11 | 9 | 7 | 11 | 7 | 7 | 7 | 5 |
| 34. | 5 | 10 | 9 | 9 | 5 | 7 | 4 | 7 | 7 | 5 | 9 | 7 | 9 |
| 35. | 5 | 9 | 10 | 9 | 7 | 5 | 7 | 7 | 9 | 7 | 7 | 9 | 9 |
| 36. | 3 | 7 | 13 | 11 | 9 | 7 | 5 | 9 | 5 | 3 | 9 | 5 | 9 |
| 37. | 3 | 9 | 11 | 8 | 5 | 7 | 5 | 9 | 7 | 5 | 7 | 10 | 11 |
| 38. | 4 | 9 | 10 | 9 | 5 | 9 | 9 | 7 | 9 | 1 | 9 | 9 | 10 |
| 39. | 3 | 7 | 9 | 9 | 5 | 7 | 7 | 7 | 7 | 1 | 7 | 9 | 11 |
| 40. | 3 | 5 | 10 | 9 | 9 | 4 | 7 | 5 | 7 | 0 | 11 | 11 | 11 |
| 41. | 3 | 8 | 9 | 5 | 1 | 5 | 11 | 5 | 11 | 1 | 9 | 9 | 11 |
| 42. | 5 | 11 | 13 | 11 | 7 | 7 | 5 | 7 | 9 | 7 | 9 | 9 | 9 |
| 43. | 7 | 9 | 9 | 8 | 7 | 7 | 5 | 8 | 7 | 9 | 7 | 7 | 9 |
| 44. | 5 | 11 | 10 | 3 | 3 | 9 | 9 | 7 | 9 | 7 | 13 | 12 | 12 |
| 45. | 5 | 8 | 11 | 11 | 5 | 9 | 6 | 7 | 8 | 3 | 9 | 7 | 13 |

APPENDIX.—(*Continued.*)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46. | 6 | 7 | 7 | 6 | 5 | 7 | 5 | 5 | 8 | 4 | 8 | 8 | 8 |
| 47. | 3 | 10 | 8 | 4 | 3 | 7 | 11 | 7 | 9 | 0 | 9 | 11 | 9 |
| 48. | 7 | 11 | 7 | 3 | 2 | 9 | 7 | 8 | 9 | 5 | 9 | 10 | 7 |
| 49. | 5 | 7 | 7 | 5 | 3 | 9 | 7 | 7 | 7 | 5 | 9 | 10 | 7 |
| 50. | 3 | 5 | 7 | 5 | 3 | 7 | 10 | 7 | 7 | 1 | 11 | 11 | 7 |
| 51. | 5 | 9 | 10 | 11 | 7 | 7 | 11 | 7 | 7 | 1 | 11 | 10 | 11 |
| 52. | 3 | 7 | 9 | 10 | 3 | 7 | 11 | 7 | 9 | 1 | 11 | 9 | 11 |
| 53. | 3 | 7 | 7 | 7 | 1 | 9 | 11 | 7 | 11 | 3 | 7 | 9 | 11 |
| 54. | 6 | 7 | 9 | 7 | 3 | 7 | 5 | 7 | 9 | 1 | 11 | 9 | 11 |
| 55. | 3 | 9 | 11 | 11 | 5 | 11 | 7 | 7 | 9 | 1 | 9 | 9 | 7 |
| 56. | 3 | 8 | 9 | 9 | 9 | 11 | 9 | 5 | 9 | 1 | 10 | 7 | 7 |
| 57. | 1 | 7 | 9 | 5 | 4 | 7 | 9 | 7 | 7 | 1 | 10 | 12 | 9 |
| 58. | 3 | 7 | 7 | 5 | 3 | 7 | 7 | 7 | 7 | 1 | 9 | 11 | 9 |
| 59. | 3 | 8 | 9 | 9 | 7 | 7 | 9 | 7 | 9 | 5 | 11 | 11 | 12 |
| 60. | 4 | 11 | 11 | 9 | 3 | 9 | 9 | 7 | 9 | 5 | 9 | 11 | 11 |
| 61. | 4 | 9 | 8 | 7 | 5 | 7 | 7 | 7 | 9 | 5 | 9 | 11 | 9 |
| 62. | 2 | 7 | 12 | 8 | 7 | 7 | 5 | 11 | 7 | 1 | 9 | 10 | 7 |
| 63. | 5 | 10 | 9 | 7 | 2 | 9 | 11 | 5 | 11 | 5 | 9 | 12 | 13 |
| 64. | 3 | 6 | 11 | 9 | 7 | 7 | 9 | 7 | 9 | 1 | 11 | 7 | 11 |
| 65. | 3 | 10 | 7 | 6 | 3 | 7 | 9 | 7 | 7 | 1 | 9 | 13 | 11 |
| 66. | 5 | 9 | 9 | 5 | 7 | 9 | 7 | 7 | 9 | 3 | 9 | 7 | 9 |
| 67. | 3 | 7 | 12 | 11 | 7 | 7 | 5 | 10 | 5 | 5 | 11 | 7 | 11 |
| 68. | 3 | 10 | 7 | 5 | 3 | 12 | 9 | 7 | 9 | 2 | 9 | 13 | 11 |
| 69. | 3 | 11 | 7 | 5 | 1 | 11 | 9 | 7 | 9 | 1 | 9 | 11 | 13 |
| 70. | 3 | 7 | 8 | 7 | 7 | 7 | 5 | 7 | 7 | 3 | 9 | 7 | 9 |
| 71. | 5 | 7 | 11 | 11 | 7 | 7 | 7 | 4 | 7 | 3 | 9 | 4 | 11 |
| 72. | 3 | 7 | 7 | 5 | 5 | 7 | 11 | 4 | 7 | 0 | 11 | 11 | 11 |
| 73. | 5 | 7 | 13 | 9 | 7 | 7 | 7 | 5 | 7 | 0 | 11 | 9 | 13 |
| 74. | 3 | 7 | 4 | 2 | 1 | 7 | 11 | 4 | 9 | 1 | 9 | 9 | 10 |
| 75. | 7 | 9 | 10 | 7 | 2 | 7 | 11 | 7 | 11 | 3 | 9 | 9 | 11 |
| 76. | 5 | 7 | 10 | 7 | 5 | 7 | 5 | 7 | 7 | 3 | 11 | 11 | 9 |
| 77. | 3 | 2 | 11 | 5 | 3 | 5 | 7 | 3 | 7 | 1 | 11 | 9 | 11 |
| 78. | 4 | 4 | 9 | 4 | 5 | 7 | 9 | 3 | 7 | 5 | 9 | 9 | 3 |
| 79. | 5 | 7 | 9 | 7 | 7 | 7 | 9 | 3 | 7 | 1 | 10 | 10 | 10 |
| 80. | 7 | 8 | 11 | 7 | 7 | 3 | 9 | 7 | 9 | 1 | 11 | 10 | 10 |
| 81. | 5 | 5 | 9 | 7 | 3 | 5 | 7 | 3 | 9 | 1 | 10 | 11 | 9 |
| 82. | 6 | 3 | 9 | 2 | 7 | 5 | 5 | 3 | 3 | 5 | 9 | 9 | 11 |
| 83. | 5 | 4 | 5 | 5 | 1 | 7 | 13 | 7 | 11 | 1 | 11 | 11 | 13 |
| 84. | 4 | 10 | 7 | 7 | 3 | 12 | 11 | 7 | 9 | 5 | 7 | 11 | 11 |
| 85. | 3 | 9 | 7 | 3 | 3 | 9 | 7 | 7 | 9 | 1 | 9 | 11 | 11 |
| 86. | 3 | 8 | 3 | 1 | 1 | 9 | 11 | 5 | 9 | 1 | 11 | 10 | 9 |
| 87. | 3 | 7 | 10 | 7 | 7 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 13 |
| 88. | 7 | 11 | 9 | 5 | 7 | 7 | 3 | 11 | 7 | 5 | 3 | 7 | 9 |
| 89. | 7 | 10 | 13 | 5 | 7 | 7 | 3 | 5 | 7 | 5 | 4 | 4 | 9 |
| 90. | 7 | 7 | 9 | 8 | 5 | 7 | 9 | 7 | 9 | 0 | 11 | 11 | 12 |
| 91. | 5 | 11 | 5 | 4 | 3 | 11 | 9 | 7 | 10 | 2 | 11 | 11 | 11 |

APPENDIX.—(*Continued.*)

| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 3 | 9 | 9 | 5 | 11 | 11 | 7 | 7 | 7 | 11 | 7 | 13 | 13 | 11 |
| 2. | 3 | 11 | 3 | 11 | 11 | 7 | 5 | 3 | 3 | 7 | 5 | 11 | 13 | 7 |
| 3. | 3 | 11 | 7 | 7 | 9 | 7 | 7 | 11 | 7 | 7 | 11 | 11 | 11 | 9 |
| 4. | 7 | 9 | 11 | 7 | 5 | 9 | 7 | 7 | 9 | 7 | 7 | 13 | 13 | 9 |
| 5. | 5 | 7 | 9 | 5 | 11 | 7 | 5 | 9 | 7 | 7 | 7 | 11 | 11 | 7 |
| 6. | 3 | 5 | 11 | 3 | 11 | 3 | 9 | 7 | 10 | 9 | 7 | 9 | 11 | 11 |
| 7. | 3 | 7 | 10 | 5 | 11 | 7 | 7 | 7 | 9 | 7 | 3 | 9 | 11 | 5 |
| 8. | 5 | 7 | 9 | 5 | 11 | 7 | 7 | 9 | 7 | 5 | 7 | 11 | 13 | 7 |
| 9. | 3 | 13 | 7 | 13 | 11 | 3 | 9 | 9 | 11 | 5 | 3 | 13 | 13 | 2 |
| 10. | 7 | 11 | 7 | 13 | 5 | 9 | 7 | 5 | 3 | 3 | 3 | 9 | 11 | 3 |
| 11. | 1 | 9 | 9 | 7 | 11 | 5 | 9 | 7 | 11 | 3 | 5 | 9 | 9 | 7 |
| 12. | 3 | 10 | 10 | 7 | 10 | 5 | 11 | 7 | 11 | 9 | 5 | 9 | 9 | 9 |
| 13. | 3 | 9 | 9 | 9 | 7 | 10 | 7 | 7 | 7 | 7 | 7 | 9 | 9 | 9 |
| 14. | 7 | 11 | 7 | 9 | 7 | 9 | 9 | 7 | 3 | 3 | 7 | 11 | 11 | 3 |
| 15. | 3 | 7 | 11 | 7 | 9 | 3 | 9 | 7 | 9 | 7 | 7 | 9 | 9 | 7 |
| 16. | 3 | 7 | 7 | 11 | 1 | 3 | 13 | 7 | 7 | 5 | 7 | 9 | 9 | 5 |
| 17. | 3 | 9 | 10 | 5 | 11 | 5 | 11 | 7 | 11 | 7 | 5 | 11 | 9 | 3 |
| 18. | 3 | 7 | 7 | 5 | 11 | 3 | 9 | 9 | 7 | 5 | 9 | 13 | 11 | 9 |
| 19. | 5 | 5 | 11 | 5 | 11 | 5 | 7 | 5 | 11 | 5 | 3 | 9 | 7 | 5 |
| 20. | 1 | 5 | 7 | 3 | 7 | 3 | 11 | 8 | 7 | 9 | 7 | 7 | 7 | 9 |
| 21. | 5 | 9 | 7 | 10 | 4 | 5 | 7 | 5 | 9 | 7 | 7 | 8 | 10 | 7 |
| 22. | 5 | 8 | 11 | 5 | 5 | 3 | 11 | 3 | 9 | 5 | 5 | 9 | 10 | 3 |
| 23. | 7 | 11 | 9 | 11 | 7 | 12 | 9 | 7 | 7 | 7 | 7 | 11 | 9 | 5 |
| 24. | 9 | 13 | 5 | 9 | 3 | 5 | 11 | 5 | 5 | 5 | 5 | 11 | 13 | 8 |
| 25. | 9 | 10 | 4 | 9 | 7 | 7 | 7 | 9 | 5 | 7 | 9 | 7 | 11 | 7 |
| 26. | 7 | 13 | 9 | 11 | 3 | 5 | 11 | 7 | 9 | 7 | 5 | 13 | 13 | 5 |
| 27. | 7 | 11 | 7 | 9 | 9 | 9 | 5 | 7 | 7 | 7 | 5 | 11 | 9 | 7 |
| 28. | 7 | 10 | 9 | 7 | 9 | 10 | 5 | 3 | 5 | 7 | 5 | 9 | 11 | 5 |
| 29. | 11 | 12 | 7 | 9 | 3 | 10 | 13 | 5 | 5 | 7 | 5 | 7 | 9 | 9 |
| 30. | 5 | 12 | 5 | 9 | 5 | 9 | 7 | 5 | 3 | 5 | 9 | 9 | 9 | 7 |
| 31. | 5 | 11 | 7 | 9 | 5 | 5 | 9 | 9 | 7 | 7 | 7 | 7 | 11 | 7 |
| 32. | 7 | 9 | 9 | 9 | 4 | 3 | 11 | 7 | 7 | 9 | 11 | 13 | 11 | 7 |
| 33. | 5 | 9 | 9 | 5 | 7 | 3 | 5 | 7 | 10 | 10 | 7 | 9 | 7 | 2 |
| 34. | 1 | 5 | 13 | 3 | 9 | 3 | 11 | 7 | 9 | 9 | 3 | 7 | 7 | 7 |
| 35. | 3 | 7 | 9 | 5 | 9 | 3 | 9 | 7 | 9 | 5 | 7 | 11 | 11 | 5 |
| 36. | 3 | 9 | 7 | 7 | 9 | 3 | 9 | 7 | 7 | 7 | 7 | 7 | 9 | 9 |
| 37. | 1 | 9 | 9 | 5 | 9 | 1 | 5 | 5 | 9 | 5 | 9 | 9 | 11 | 7 |
| 38. | 3 | 5 | 7 | 3 | 10 | 4 | 3 | 5 | 7 | 5 | 5 | 4 | 7 | 3 |
| 39. | 3 | 5 | 7 | 3 | 10 | 5 | 9 | 5 | 7 | 5 | 5 | 11 | 13 | 3 |
| 40. | 7 | 7 | 7 | 7 | 11 | 11 | 3 | 5 | 7 | 5 | 3 | 9 | 11 | 7 |
| 41. | 3 | 7 | 9 | 3 | 12 | 7 | 5 | 13 | 9 | 9 | 11 | 9 | 13 | 9 |
| 42. | 3 | 7 | 9 | 3 | 9 | 2 | 7 | 7 | 9 | 9 | 9 | 9 | 3 | 7 |
| 43. | 3 | 9 | 7 | 3 | 9 | 3 | 9 | 5 | 7 | 5 | 11 | 11 | 9 | 5 |
| 44. | 2 | 7 | 13 | 1 | 13 | 3 | 7 | 13 | 11 | 7 | 7 | 11 | 11 | 9 |
| 45. | 2 | 7 | 8 | 4 | 10 | 3 | 10 | 8 | 7 | 9 | 5 | 8 | 12 | 12 |

APPENDIX.—(*Continued.*)

| | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46. | 9 | 10 | 10 | 11 | 4 | 7 | 5 | 6 | 8 | 6 | 3 | 11 | 9 | 6 |
| 47. | 3 | 7 | 11 | 5 | 11 | 7 | 7 | 5 | 9 | 7 | 7 | 7 | 7 | 7 |
| 48. | 7 | 7 | 12 | 5 | 9 | 3 | 9 | 7 | 9 | 9 | 5 | 9 | 5 | 7 |
| 49. | 7 | 11 | 9 | 11 | 9 | 11 | 3 | 5 | 5 | 5 | 5 | 9 | 9 | 7 |
| 50. | 3 | 2 | 9 | 3 | 11 | 7 | 5 | 5 | 5 | 5 | 5 | 9 | 11 | 2 |
| 51. | 3 | 7 | 11 | 3 | 11 | 3 | 7 | 7 | 7 | 7 | 5 | 7 | 11 | 5 |
| 52. | 3 | 7 | 9 | 5 | 11 | 3 | 7 | 7 | 9 | 7 | 7 | 9 | 11 | 7 |
| 53. | 3 | 9 | 12 | 5 | 9 | 5 | 9 | 7 | 11 | 7 | 7 | 7 | 11 | 7 |
| 54. | 5 | 9 | 7 | 7 | 9 | 11 | 9 | 7 | 7 | 5 | 5 | 9 | 11 | 9 |
| 55. | 7 | 4 | 10 | 3 | 9 | 3 | 10 | 7 | 9 | 11 | 10 | 7 | 11 | 9 |
| 56. | 3 | 5 | 7 | 3 | 11 | 3 | 3 | 7 | 7 | 5 | 7 | 10 | 12 | 8 |
| 57. | 3 | 3 | 10 | 3 | 11 | 4 | 1 | 5 | 9 | 5 | 5 | 3 | 9 | 7 |
| 58. | 3 | 7 | 9 | 3 | 12 | 7 | 3 | 7 | 7 | 7 | 5 | 7 | 9 | 9 |
| 59. | 3 | 5 | 10 | 3 | 11 | 3 | 3 | 7 | 9 | 7 | 7 | 7 | 12 | 9 |
| 60. | 3 | 5 | 11 | 3 | 11 | 3 | 10 | 7 | 11 | 7 | 7 | 7 | 7 | 5 |
| 61. | 3 | 7 | 9 | 5 | 9 | 3 | 7 | 7 | 9 | 9 | 7 | 5 | 7 | 7 |
| 62. | 3 | 7 | 7 | 4 | 9 | 3 | 11 | 5 | 5 | 9 | 3 | 7 | 7 | 2 |
| 63. | 1 | 7 | 9 | 3 | 13 | 4 | 7 | 9 | 11 | 7 | 7 | 7 | 11 | 7 |
| 64. | 3 | 9 | 5 | 3 | 11 | 7 | 3 | 9 | 7 | 7 | 5 | 5 | 7 | 9 |
| 65. | 3 | 4 | 11 | 3 | 11 | 5 | 4 | 7 | 9 | 7 | 7 | 7 | 10 | 10 |
| 66. | 5 | 7 | 10 | 5 | 9 | 5 | 7 | 7 | 10 | 5 | 5 | 7 | 7 | 9 |
| 67. | 3 | 5 | 7 | 3 | 7 | 3 | 9 | 9 | 7 | 3 | 5 | 4 | 3 | 9 |
| 68. | 3 | 5 | 13 | 3 | 11 | 3 | 8 | 7 | 11 | 7 | 7 | 7 | 7 | 9 |
| 69. | 3 | 7 | 13 | 3 | 11 | 3 | 7 | 8 | 11 | 9 | 7 | 11 | 9 | 9 |
| 70. | 7 | 9 | 9 | 5 | 5 | 3 | 12 | 7 | 11 | 7 | 5 | 5 | 7 | 3 |
| 71. | 5 | 7 | 7 | 3 | 9 | 7 | 9 | 7 | 7 | 5 | 10 | 5 | 5 | 7 |
| 72. | 3 | 5 | 9 | 3 | 11 | 9 | 3 | 9 | 7 | 5 | 11 | 5 | 7 | 9 |
| 73. | 1 | 9 | 7 | 5 | 7 | 3 | 7 | 7 | 7 | 5 | 7 | 11 | 11 | 7 |
| 74. | 7 | 7 | 11 | 5 | 9 | 5 | 3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 75. | 5 | 11 | 7 | 7 | 7 | 8 | 7 | 7 | 7 | 9 | 5 | 9 | 7 | 7 |
| 76. | 3 | 3 | 7 | 3 | 7 | 4 | 5 | 5 | 7 | 7 | 9 | 7 | 7 | 7 |
| 77. | 3 | 7 | 7 | 3 | 11 | 9 | 2 | 7 | 4 | 7 | 10 | 3 | 3 | 7 |
| 78. | 7 | 5 | 7 | 7 | 7 | 6 | 5 | 7 | 5 | 11 | 3 | 5 | 9 | 3 |
| 79. | 1 | 1 | 7 | 3 | 13 | 5 | 4 | 7 | 9 | 7 | 5 | 5 | 5 | 9 |
| 80. | 3 | 5 | 9 | 5 | 11 | 3 | 8 | 7 | 7 | 7 | 5 | 7 | 7 | 7 |
| 81. | 3 | 3 | 5 | 3 | 11 | 7 | 3 | 7 | 7 | 9 | 7 | 3 | 3 | 11 |
| 82. | 3 | 9 | 7 | 7 | 9 | 9 | 7 | 13 | 3 | 5 | 3 | 7 | 9 | 3 |
| 83. | 3 | 9 | 11 | 7 | 9 | 9 | 5 | 13 | 7 | 7 | 7 | 9 | 9 | 5 |
| 84. | 3 | 5 | 11 | 3 | 12 | 3 | 3 | 9 | 11 | 7 | 7 | 9 | 9 | 5 |
| 85. | 3 | 7 | 10 | 3 | 9 | 3 | 7 | 9 | 9 | 9 | 5 | 9 | 9 | 11 |
| 86. | 3 | 7 | 11 | 7 | 12 | 5 | 1 | 8 | 7 | 8 | 7 | 7 | 10 | 5 |
| 87. | 1 | 9 | 7 | 3 | 9 | 3 | 7 | 13 | 7 | 5 | 5 | 7 | 11 | 3 |
| 88. | 7 | 7 | 9 | 7 | 7 | 5 | 12 | 7 | 9 | 5 | 9 | 9 | 7 | 7 |
| 89. | 5 | 11 | 9 | 7 | 7 | 3 | 13 | 5 | 7 | 3 | 5 | 7 | 7 | 7 |
| 90. | 3 | 5 | 7 | 3 | 11 | 7 | 7 | 7 | 7 | 7 | 5 | 7 | 7 | 7 |
| 91. | 3 | 3 | 11 | 3 | 11 | 4 | 3 | 9 | 9 | 12 | 9 | 5 | 7 | 9 |

APPENDIX.—(*Continued.*)

| | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 18 | 9 | 9 | 7 | 5 | 9 | 9 | 11 | 5 | 13 | 13 | 13 |
| 2. | 11 | 9 | 7 | 7 | 5 | 9 | 5 | 5 | 5 | 7 | 9 | 11 |
| 3. | 12 | 7 | 7 | 9 | 7 | 7 | 5 | 7 | 5 | 11 | 9 | 9 |
| 4. | 12 | 9 | 7 | 7 | 7 | 11 | 9 | 5 | 11 | 5 | 7 | 7 |
| 5. | 16 | 7 | 7 | 8 | 7 | 5 | 7 | 8 | 5 | 10 | 7 | 7 |
| 6. | 11 | 9 | 9 | 9 | 9 | 9 | 11 | 2 | 7 | 11 | 7 | 9 |
| 7. | 11 | 3 | 7 | 7 | 7 | 9 | 11 | 8 | 7 | 11 | 7 | 9 |
| 8. | 12 | 7 | 5 | 7 | 7 | 9 | 9 | 5 | 7 | 7 | 8 | 11 |
| 9. | 9 | 7 | 3 | 7 | 3 | 13 | 11 | 3 | 7 | 8 | 7 | 7 |
| 10. | 9 | 5 | 11 | 5 | 5 | 7 | 7 | 7 | 5 | 8 | 7 | 7 |
| 11. | 13 | 11 | 11 | 13 | 5 | 7 | 11 | 7 | 7 | 10 | 5 | 7 |
| 12. | 12 | 9 | 7 | 9 | 11 | 7 | 7 | 5 | 7 | 8 | 9 | 5 |
| 13. | 13 | 7 | 7 | 7 | 9 | 7 | 7 | 5 | 5 | 11 | 7 | 11 |
| 14. | 13 | 5 | 3 | 3 | 2 | 9 | 9 | 7 | 5 | 9 | 9 | 13 |
| 15. | 14 | 5 | 7 | 7 | 5 | 9 | 9 | 7 | 5 | 9 | 9 | 9 |
| 16. | 13 | 5 | 7 | 3 | 5 | 7 | 11 | 9 | 5 | 9 | 5 | 10 |
| 17. | 8 | 3 | 3 | 3 | 7 | 11 | 11 | 7 | 7 | 7 | 7 | 7 |
| 18. | 14 | 9 | 7 | 9 | 9 | 11 | 12 | 10 | 7 | 11 | 10 | 9 |
| 19. | 10 | 5 | 5 | 5 | 9 | 7 | 11 | 5 | 7 | 9 | 7 | 7 |
| 20. | 13 | 9 | 7 | 9 | 9 | 8 | 7 | 5 | 11 | 11 | 9 | 7 |
| 21. | 14 | 7 | 7 | 7 | 7 | 5 | 9 | 7 | 7 | 5 | 7 | 7 |
| 22. | 11 | 4 | 3 | 3 | 4 | 9 | 10 | 3 | 5 | 8 | 7 | 7 |
| 23. | 14 | 9 | 9 | 5 | 8 | 7 | 9 | 7 | 7 | 10 | 9 | 9 |
| 24. | 10 | 7 | 9 | 7 | 9 | 9 | 5 | 7 | 5 | 11 | 7 | 7 |
| 25. | 11 | 7 | 5 | 3 | 7 | 7 | 9 | 7 | 5 | 8 | 9 | 9 |
| 26. | 11 | 3 | 5 | 1 | 5 | 13 | 10 | 3 | 5 | 8 | 11 | 9 |
| 27. | 7 | 4 | 5 | 7 | 11 | 5 | 9 | 9 | 7 | 7 | 7 | 9 |
| 28. | 14 | 9 | 7 | 7 | 3 | 7 | 9 | 8 | 5 | 9 | 7 | 7 |
| 29. | 10 | 4 | 7 | 3 | 3 | 7 | 13 | 9 | 5 | 11 | 7 | 3 |
| 30. | 9 | 7 | 9 | 9 | 3 | 2 | 9 | 3 | 5 | 8 | 7 | 9 |
| 31. | 11 | 7 | 7 | 4 | 3 | 9 | 10 | 7 | 7 | 9 | 7 | 7 |
| 32. | 13 | 3 | 5 | 3 | 9 | 9 | 11 | 7 | 5 | 13 | 5 | 5 |
| 33. | 12 | 5 | 5 | 7 | 7 | 9 | 11 | 7 | 5 | 11 | 7 | 9 |
| 34. | 13 | 5 | 7 | 7 | 7 | 7 | 13 | 5 | 7 | 10 | 9 | 9 |
| 35. | 10 | 7 | 7 | 9 | 9 | 9 | 11 | 3 | 9 | 9 | 11 | 7 |
| 36. | 7 | 7 | 5 | 9 | 7 | 7 | 12 | 7 | 7 | 13 | 9 | 5 |
| 37. | 10 | 11 | 9 | 11 | 7 | 7 | 7 | 5 | 7 | 7 | 7 | 7 |
| 38. | 4 | 9 | 7 | 9 | 7 | 7 | 9 | 1 | 7 | 7 | 7 | 7 |
| 39. | 14 | 9 | 9 | 11 | 7 | 9 | 5 | 1 | 7 | 9 | 9 | 9 |
| 40. | 7 | 9 | 9 | 11 | 7 | 3 | 3 | 1 | 3 | 9 | 7 | 7 |
| 41. | 13 | 12 | 12 | 11 | 7 | 7 | 3 | 3 | 7 | 11 | 7 | 7 |
| 42. | 4 | 7 | 7 | 11 | 9 | 9 | 11 | 7 | 9 | 9 | 7 | 9 |
| 43. | 11 | 7 | 7 | 9 | 5 | 11 | 11 | 10 | 5 | 12 | 9 | 9 |
| 44. | 12 | 9 | 9 | 11 | 9 | 9 | 9 | 8 | 11 | 9 | 7 | 7 |
| 45. | 10 | 7 | 7 | 11 | 7 | 10 | 9 | 3 | 6 | 11 | 7 | 7 |

APPENDIX.—(*Continued.*)

| | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 46. | 6 | 4 | 5 | 8 | 10 | 9 | 4 | 3 | 7 | 3 | 5 | 7 |
| 47. | 10 | 9 | 9 | 10 | 7 | 9 | 7 | 3 | 7 | 9 | 7 | 7 |
| 48. | 9 | 5 | 7 | 7 | 5 | 11 | 11 | 3 | 11 | 7 | 7 | 9 |
| 49. | 12 | 7 | 9 | 7 | 7 | 5 | 5 | 5 | 7 | 9 | 9 | 9 |
| 50. | 10 | 7 | 7 | 11 | 7 | 7 | 9 | 2 | 9 | 3 | 5 | 5 |
| 51. | 10 | 9 | 7 | 9 | 7 | 9 | 5 | 7 | 9 | 10 | 9 | 9 |
| 52. | 10 | 9 | 9 | 11 | 7 | 9 | 3 | 7 | 5 | 7 | 7 | 5 |
| 53. | 10 | 7 | 7 | 9 | 9 | 11 | 5 | 5 | 7 | 4 | 7 | 9 |
| 54. | 11 | 9 | 9 | 10 | 7 | 9 | 3 | 9 | 7 | 2 | 3 | 11 |
| 55. | 13 | 5 | 5 | 9 | 7 | 9 | 7 | 3 | 5 | 4 | 12 | 10 |
| 56. | 7 | 5 | 5 | 9 | 7 | 11 | 7 | 2 | 11 | 8 | 9 | 7 |
| 57. | 10 | 12 | 10 | 9 | 5 | 5 | 3 | 2 | 5 | 12 | 9 | 7 |
| 58. | 15 | 11 | 9 | 11 | 7 | 5 | 9 | 7 | 11 | 9 | 9 | 9 |
| 59. | 13 | 7 | 7 | 9 | 9 | 7 | 5 | 3 | 7 | 7 | 9 | 7 |
| 60. | 9 | 7 | 7 | 11 | 7 | 7 | 5 | 2 | 11 | 11 | 9 | 7 |
| 61. | 10 | 7 | 7 | 9 | 7 | 7 | 5 | 2 | 7 | 9 | 9 | 9 |
| 62. | 14 | 7 | 7 | 8 | 9 | 4 | 12 | 9 | 5 | 13 | 7 | 7 |
| 63. | 13 | 9 | 9 | 12 | 7 | 9 | 7 | 3 | 7 | 5 | 11 | 11 |
| 64. | 7 | 7 | 5 | 9 | 9 | 5 | 7 | 6 | 7 | 6 | 7 | 7 |
| 65. | 14 | 9 | 11 | 11 | 7 | 7 | 5 | 3 | 7 | 9 | 8 | 10 |
| 66. | 12 | 7 | 7 | 9 | 10 | 7 | 5 | 3 | 3 | 7 | 3 | 7 |
| 67. | 7 | 7 | 7 | 9 | 4 | 4 | 7 | 7 | 9 | 7 | 7 | 9 |
| 68. | 12 | 9 | 7 | 9 | 9 | 7 | 9 | 3 | 9 | 11 | 9 | 7 |
| 69. | 12 | 11 | 9 | 12 | 9 | 10 | 5 | 2 | 5 | 7 | 7 | 7 |
| 70. | 14 | 9 | 7 | 9 | 7 | 7 | 9 | 5 | 5 | 7 | 7 | 9 |
| 71. | 9 | 7 | 9 | 9 | 7 | 7 | 5 | 5 | 5 | 9 | 7 | 7 |
| 72. | 15 | 9 | 9 | 9 | 5 | 5 | 7 | 5 | 7 | 7 | 7 | 7 |
| 73. | 11 | 9 | 7 | 11 | 5 | 11 | 5 | 5 | 7 | 10 | 7 | 7 |
| 74. | 10 | 9 | 11 | 9 | 11 | 7 | 3 | 11 | 5 | 9 | 7 | 7 |
| 75. | 11 | 7 | 5 | 9 | 9 | 13 | 7 | 5 | 7 | 7 | 7 | 7 |
| 76. | 11 | 9 | 7 | 12 | 9 | 5 | 7 | 8 | 5 | 11 | 7 | 7 |
| 77. | 11 | 7 | 7 | 11 | 9 | 2 | 3 | 3 | 5 | 11 | 7 | 7 |
| 78. | 6 | 7 | 5 | 7 | 7 | 3 | 9 | 3 | 7 | 9 | 7 | 3 |
| 79. | 10 | 9 | 9 | 9 | 7 | 5 | 5 | 5 | 7 | 11 | 7 | 7 |
| 80. | 10 | 12 | 9 | 11 | 5 | 3 | 5 | 4 | 5 | 11 | 7 | 5 |
| 81. | 7 | 11 | 11 | 9 | 7 | 2 | 3 | 2 | 3 | 11 | 5 | 7 |
| 82. | 7 | 7 | 7 | 3 | 5 | 5 | 5 | 1 | 3 | 11 | 7 | 9 |
| 83. | 12 | 11 | 9 | 11 | 7 | 3 | 1 | 3 | 7 | 9 | 11 | 9 |
| 84. | 10 | 7 | 9 | 11 | 9 | 9 | 3 | 1 | 7 | 9 | 9 | 9 |
| 85. | 12 | 9 | 9 | 9 | 7 | 9 | 9 | 3 | 7 | 10 | 7 | 7 |
| 86. | 10 | 11 | 9 | 11 | 7 | 7 | 5 | 7 | 9 | 11 | 7 | 7 |
| 87. | 11 | 7 | 3 | 10 | 7 | 5 | 9 | 3 | 7 | 8 | 9 | 11 |
| 88. | 12 | 5 | 5 | 5 | 7 | 9 | 11 | 7 | 7 | 9 | 5 | 3 |
| 89. | 13 | 3 | 7 | 5 | 4 | 10 | 11 | 2 | 3 | 13 | 5 | 2 |
| 90. | 11 | 11 | 11 | 9 | 7 | 7 | 5 | 2 | 9 | 9 | 9 | 9 |
| 91. | 11 | 7 | 7 | 7 | 10 | 5 | 5 | 3 | 9 | 9 | 9 | 9 |

It gives support to the hypothesis that fear and anger are independent gene-caused traits in man. The correlation is −.14; and Burt found a similar slight negative correlation as an exception to his general view of emotional linkages.[3]

[FOOTNOTE FOR APPENDIX]

In the ratings given here, with certain exceptions which will be noted, the integers correspond to half standard deviation units of the distribution of white males in the United States, while the median of this distribution is represented by the number 7. The exceptions are as follows:

*Variable 4. Curiosity.* This is a composite of two separate ratings. It is expressed so that the neutral point is 12, and its standard deviation in the population would be more than 2.

*Variable 37. Liking for art, music, beauty.* Also a composite. Indifference point 10.0, and standard deviation greater than 2.

*Variable 10. Craving for approval.* The number scale has been shifted so that the presumed population median for this variable is 3.

*Variable 19. Rathymia.* Number scale shifted so that presumed population median is 5.

*Variable 23. Inferiority.* Number scale shifted so that presumed population median is 5.

[3] At this point the manuscript comes to an end. It is clearly unfinished, but I do not know on what further aspects of the data my father intended to comment. The results are now available to all for such further analysis and interpretation as they may care to make. [R. L. T.]

## CARL E. SEASHORE

### 1866–1949

Experimental methods were introduced in the study of human behavior during the latter part of the Nineteenth Century. The first psychological laboratory was established in 1879 by Wilhelm Wundt at the University of Leipzig. Immediately thereafter American universities followed with the founding of a score of psychological laboratories before the end of the century.

During the next fifty years psychology as a science grew from an infant to a husky youth. At first emphasis was largely on sensory and perceptual processes as measured by motor responses and reaction times. Very soon, however, the field broadened. Interests of investigators expanded enormously to cover a wide variety of aspects of human behavior and social relations: learning and growth, aptitudes and interests, motivations and incentives, attitudes and opinions, intelligence and personality. Ventures into these new fields called for refinements in method and particularly the application of statistical techniques.

Furthermore this first half of the Twentieth Century is also the period during which American universities overtook European centers of learning and rose to world leadership in research.

Carl E. Seashore's adult life span coincided with this half century of the flowering of research in American universities. The uniqueness of his contribution is the combination of outstanding achievement and leadership (1) not only in his own field of psychology as an investigator and guide of the graduate work of numerous students, but (2) also in the over-all field of graduate research at the University of Iowa in setting high standards of attainment.

For forty years he was director of the psychological laboratory and for thirty of these years he was also dean of the graduate college followed by a decade of semi-retirement devoted to research and writing. Coming almost immediately, after his graduate studies at Yale, to Iowa in 1897, his half century of teaching, research and administrative leadership is unequalled at the University of Iowa and probably seldom matched anywhere else.

Dr. Seashore came from sturdy pioneer stock and carried these same qualities into his pioneering in psychology. He was born

in Morlunda, Sweden, January 28, 1866. When three years old his family moved to the United States and settled in Iowa. He was graduated from Gustavus Adolphus College, St. Peter, Minnesota, in 1891. He received his doctorate at Yale in 1895 and after two years as assistant at Yale, he came to the University of Iowa to take charge of the psychological laboratory whose beginnings had been made by Professor George T. W. Patrick.

In his early years he invented the Voice Tonoscope, the Audiometer, and the Sound Perimeter. Among his chief contributions to psychological science was his development of a system of analysis and measurement of musical aptitude as a basis for vocational guidance in music. Another of his major achievements was the establishment of the Child Welfare Research Station.

Through Dean Seashore's vision and perseverance, the Iowa psychological laboratory became one of a small handful of top-ranking laboratories, both in research contributions and in training outstanding professional leaders.

He was a member of Sigma Xi and a fellow of the American Psychological Association of which he was president in 1911. In 1920 he was chairman of the division of Psychology and Anthropology of the National Research Council. He received many honors and recognitions. In 1948 the Board of Education of the state of Iowa conferred upon him the title of "Distinguished Service Professor."

Dr. Seashore died on October 16, 1949, only two months after his wife had passed away. Always closely tied to each other and supplementing each other's interests, their home and family were their delight and satisfaction. Only those who were privileged to come under his guidance and sense the philosophy that permeated his work and his home, can fully appreciate his worth and influence.

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# NOTES ON THE MEASUREMENT OF MENTAL SPEED

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Mental speed or rate of performing intellectual tasks has long been of interest to psychologists. The two most persistent issues—and they are related—have been whether mental speed is independent of difficulty and type of task and whether it is indicative of profundity or altitude of intellect, accuracy or quality of work, temperamental factors, achievement in school, and vocational success.

The inconsistencies and contradictions in the voluminous literature suggest either that speed is an unstable dimension of intellect or that inappropriate units and methods of measuring it have frequently been employed. Regarding the latter possibility, it is easy to show that the findings in a number of studies may have been consequent to the method of investigation, rather than to the rôle of speed. Substantial correlation of scores obtained from timed and untimed administration of group tests, in view of the part-whole circumstance, is inevitable—whatever the relation of speed to altitude. The meaning of the significant inverse relationship between cumulative accuracy scores and total times spent on a test would be expected due to the fact that inaccuracy or error decreases speed as well as cumulative accuracy scores. The equivalence of work limit and time limit scores on low difficulty tests is consequent to the definitions of the former as the average time required to complete an item and of the latter as the number of items completed in unit time. As defined, the measures obviously tend to be related as arithmetic and harmonic means. In some of the more careful studies, characterized by timing each subject on each task, control of accuracy and use of statistical test, speed has been found to be significantly correlated with altitude. In others, it has been found to be unstable, as difficulty of task varies. These more careful studies, in general, have been inconclusive because of extreme skewness and lack of homogeneity of variance of the speed measures or because of loss of independence of the measures when converted into scores based upon group per-

formance on each task, such as percentile ranks and deviation scores.

There is a steadily increasing body of evidence that speed of response, when appropriately measured, is a stable and independent ability. Factor analyses of the intercorrelations of scores on speeded tests of low difficulty have consistently isolated a speed factor. Baxter,[1] Davidson and Carroll[2] and others have found the ability to be elicited by mental test materials of higher difficulty. In the writer's study[5] both a general speed ability and a special speed ability linked to function were found operative in response to four types of mental test materials of varying degrees of difficulty.

The hypothesis of a general ability in speed, independent of mental altitude and independent of function in which it is observed appears to be tenable. The ability has been observed in the testing situation, and, since this situation tends to equalize motivation, the magnitude of the differences observed probably is at a minimum. Is it an important individual difference? At present, little is known about its nature or its correlatives. It may be a native trait. It may be a set for a particular rate of work. A number of factor analysts have concluded that the factor, as elicited by low difficulty tasks, either is an ability or a readiness for discovering and identifying perceptual detail. If so, it may be inherent in the mental act itself, in a habitual way of going about a task, or in efficiency of use of mental power. Perhaps it is a basic component of that psychological complex known as temperament.

Practically, however, these questions are not as important as the questions regarding mental speed correlatives. Do individual differences in speed set off occupational groups or successful workers within groups? Are there antecedent-consequent relations between, say, speed in verbal ability and success in occupations requiring the ready word and pen, such as lecturing and journalism? Is there a speed loading in school marks? Are there racial differences in speed? If speed is a basic component of temperament, does it act as one of the determiners in the subtle process of selecting friends and mates? Is it associated with conservatism-radicalism attitudes? Is it related to persistence? Do individuals differ in variability as well as in

mean speed in responding to a set of tasks, and, if so, does the difference in variability provide useful information?

There are a great many provocative problems relating to the rôle of speed in behavior. It is the purpose of this paper to consider some of the difficulties which come up in the measurement of mental speed and to suggest methods of obtaining reliable measures of it.

## METHODS AND MATERIALS

Among the kinds of studies of particular interest and importance are (1) the selection of tasks which reliably tap speed, (2) the effect of experimental treatments upon speed, and (3) the correlatives of speed. The first, of course, is basic to any study, and it requires that each individual in the sample under investigation be timed on each task. Individual timing eliminates irrelevant time loss due to search for attractive items and failure to complete undertaken tasks, permits control of the effect of inaccuracy, and provides data for precise study of reliability. Total times on tests in group situations may provide useful information for some purposes, but they do not provide a satisfactory basis for individual comparisons. They tell little about how time is spent and nothing about variability within the individual.

For several reasons typical intelligence test items are well-adapted to studying speed of response. These items tend to require from about eight to forty seconds, on the average, from the individuals for whom they are designed; they are relatively free from familiarity and practice effects; and they can be selected so as to tap reliably a number of partially independent functions. Shorter items are proportionately more affected by errors in timing and time differences ascribable to different rates of reading the stimulus material and indicating the response, while the probability of time loss due to gross irrelevancies tends to be greater in the longer.

There likely are many other sorts of paper-and-pencil and performance tasks which would prove well-adapted to particular problems. For example, extensive sets of arithmetic exercises or monotonous manipulatory tasks might be found appropriate for determining whether variation in speed of response during

long and tiring periods of work can be associated with, say, persistence.

It is reasonable to surmise that the tasks should be of completion rather than of multiple choice type, since time pressure likely tends to increase guessing. The relation of speed to motivation in an individual, in general, probably is very close; in fact, if it were possible to obtain a sort of average speed index for an individual, based upon performances under varying degrees of motivation, it might be possible to study motivation quantitatively. Be that as it may, it seems evident that the individual subjects in a speed study should be working for speed and accuracy, under the most comparable motivating conditions possible.

## AN APPROPRIATE UNIT OF MEASUREMENT

When a number of short, homogeneous tasks are individually administered and timed in seconds, the distributions of time scores of the individuals in the sample will be characterized by severe nonnormality and heterogeneity of variance. The development of precise statistical tests applicable to such distributions is a matter of great complexity, if possible at all. Thus, the average investigator must either forgo exact statistical analysis of the speed measures or must find a method of introducing normality and homogeneity without destroying the independence of the measures.

In his examination of a random sample of the distributions of speed measures of thirty-six high-school students on arithmetic reasoning, number series, sentence completion and spatial relations tests, the writer[5] found the common logarithms of the times in seconds to be distributed normally with acceptably homogeneous variance, as judged by the Chi-square and $L_1$ criterions. Each test contained about sixty items of mainly twenty to sixty per cent difficulty, in terms of percentages failing. Since that study, the writer has examined a great many sets of response times and has found that taking the common logarithms of the times in seconds has always improved the normality and has usually improved the homogeneity conditions.

It is pertinent here to examine the 'raw' time and log time distributions of several samples of individuals on various kinds of tasks. The distributions in Table I are based on Peak's and

Boring's report[4] of the results of administering Forms A and B of the *Otis Self-Administering Test of Mental Ability, Higher Examination,* to two male and three female university students. The investigators report only the rounded number of seconds for

TABLE I.—DISTRIBUTIONS OF CORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF FIVE UNIVERSITY STUDENTS ON OTIS MENTAL TEST-ITEMS

| Time in Seconds | Subjects | | | | | Time in Log Seconds* | Subjects | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | | A | B | C | D | E |
| 0–4 | 5 | 7 | 4 | 1 | 1 | 26–38 | 2 | 1 | 1 | | |
| 5–9 | 36 | 29 | 31 | 13 | 7 | 39–51 | 1 | 2 | | | |
| 10–14 | 25 | 25 | 24 | 26 | 23 | 52–64 | 2 | 4 | 3 | 1 | 1 |
| 15–19 | 14 | 15 | 18 | 21 | 16 | 65–77 | 14 | 10 | 10 | 2 | 1 |
| 20–24 | 8 | 10 | 10 | 9 | 17 | 78–90 | 13 | 13 | 13 | 6 | 3 |
| 25–29 | 3 | 5 | 1 | 5 | 9 | 91–103 | 15 | 14 | 14 | 9 | 10 |
| 30–34 | 3 | 4 | 6 | 7 | 7 | 104–116 | 19 | 17 | 18 | 22 | 16 |
| 35–39 | | 3 | 1 | 7 | 3 | 117–129 | 14 | 16 | 18 | 21 | 17 |
| 40–44 | 2 | | 2 | 2 | 2 | 130–142 | 10 | 13 | 11 | 13 | 20 |
| 45–49 | | | 2 | 3 | 4 | 143–155 | 4 | 6 | 6 | 8 | 13 |
| 50–54 | | 1 | | 1 | 3 | 156–168 | 2 | 2 | 5 | 11 | 8 |
| 55–59 | | | | | 2 | 169–181 | 3 | 1 | | 3 | 6 |
| 60–64 | 3 | | | 1 | 1 | 182–194 | 1 | 1 | 1 | 2 | 3 |
| 65–69 | 1 | | | | | 195–207 | | | | 1 | 2 |
| 70–74 | | | | 1 | 1 | | | | | | |
| 75–79 | | 1 | 1 | 1 | 2 | | | | | | |
| 80–84 | | | | | | | | | | | |
| 85–89 | | | | | | | | | | | |
| 90–94 | | | | | 1 | | | | | | |
| 95–99 | | | | 1 | | | | | | | |
| 100–104 | | | | | | | | | | | |
| 105–109 | | | | | 1 | | | | | | |
| N | 100 | 100 | 100 | 99 | 100 | N | 100 | 100 | 100 | 99 | 100 |
| Mean | 14.40 | 14.95 | 15.50 | 21.85 | 25.80 | Mean | 105.7 | 107.0 | 109.5 | 125.5 | 131.7 |
| Sum of Squares | 15675 | 12350 | 13252 | 25428 | 35550 | Sum of Squares | 91935 | 87152 | 79733 | 74920 | 78755 |

* Common logarithms of the times in seconds, rounded to two-place mantissas and multiplied by 100.

the subjects on the items all worked correctly. (Subject D spent 400 seconds on one of the items. That score is not included in the Table.) Common logarithms with two place mantissas were taken of the times in seconds and multiplied by 100 to

eliminate decimals. For the sake of table compactness a uniform grouping scheme is employed in forming the distributions. Where rounding to the nearest second could affect the log scores to the extent of changing class membership, the log scores are assigned proportionately to the classes affected. Considering

TABLE II.—DISTRIBUTIONS OF CORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF FOUR HIGH-SCHOOL SENIORS ON MINNESOTA PAPER FORM BOARD ITEMS

| Time in Seconds | Subject | | | | Time in Log Seconds* | Subject | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 |
| 0–4 | 3 | 1 | | | 40–49 | 1 | | | |
| 5–9 | 21 | 19 | 7 | 4 | 50–59 | 1 | 1 | | |
| 10–14 | 9 | 11 | 14 | 6 | 60–69 | 2 | 1 | | |
| 15–19 | 10 | 4 | 12 | 15 | 70–79 | 5 | 5 | 1 | 1 |
| 20–24 | 5 | 2 | 11 | 6 | 80–89 | 7 | 4 | 3 | |
| 25–29 | 4 | 3 | 7 | 7 | 90–99 | 7 | 9 | 4 | 4 |
| 30–34 | 1 | 1 | 3 | 2 | 100–109 | 8 | 8 | 8 | 3 |
| 35–39 | | 1 | 1 | 1 | 110–119 | 7 | 4 | 8 | 12 |
| 40–44 | | 1 | 1 | 1 | 120–129 | 6 | 3 | 8 | 5 |
| 45–49 | | | 1 | 1 | 130–139 | 5 | 2 | 11 | 8 |
| 50–54 | | 1 | 1 | 1 | 140–149 | 3 | 3 | 8 | 5 |
| 55–59 | 1 | | | | 150–159 | 1 | 2 | 3 | 3 |
| 60–64 | 1 | | | | 160–169 | | 1 | 2 | 2 |
| | | | | | 170–179 | 1 | 1 | 1 | 1 |
| | | | | | 180–189 | 1 | | 1 | |

* Common logarithms of the times in seconds, rounded to two-place mantissas and multiplied by 100.

the raw time distributions for Subjects A and E, which appear least similar, the ratios of Fisher's $g_1$ and $g_2$ statistics[3] to their standard errors are about 11 and 15 and 8 and 9, respectively. In the log distributions, the ratios are .9 and .3 and .8 and .5. The effect of the log transformations on the variances is very marked. The F-ratios of the raw time variances for Subjects A and E is 2.25; that of the log time variances, 1.17. A ratio of

about 1.59 is significant at the one per cent level. It is interesting to note that Peak and Boring, after transforming the times of response by taking "1000 time the ratio of the time of one subject to the total time of the five subjects on any item" observed a difference between the mean times of Subjects A and E of about 11.9 times its standard error. Based upon the log measures, the critical ratio is about 4.3.

Table II gives the distributions of raw and log times of correct response of four college preparatory high-school seniors to the sixty-four items of the Minnesota Paper Form Board, Form A, test. Two of the four subjects were girls. All were of superior academic aptitude and of approximately the same chronological age. The improvement effected by the log transformation is

TABLE III.—POOLED DISTRIBUTIONS OF CORRECT AND INCORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF FIVE HIGH-SCHOOL GIRLS ON THIRTY SENTENCE COMPLETION ITEMS*

| Time in Seconds | Correct Response | Incorrect Response | Time in† Log Seconds | Correct Response | Incorrect Response |
|---|---|---|---|---|---|
| 0–8 | 17 | 5 | 26–38 | 1 | |
| 9–17 | 36 | 14 | 39–51 | 2 | |
| 18–26 | 18 | 8 | 52–64 | 2 | |
| 27–35 | 13 | 10 | 65–77 | 3 | 1 |
| 36–44 | 3 | 5 | 78–90 | 7 | 3 |
| 45–53 | 2 | 1 | 91–103 | 13 | 3 |
| 54–62 | 1 | 1 | 104–116 | 15 | 7 |
| 63–71 | 2 | 3 | 117–129 | 17 | 8 |
| 72–80 | 1 | | 130–142 | 11 | 5 |
| 81–89 | | | 143–155 | 13 | 10 |
| 90–98 | | | 156–168 | 5 | 5 |
| 99–107 | | 1 | 169–181 | 2 | 3 |
| 108–116 | | 2 | 182–194 | 2 | 2 |
| 117–125 | | | 195–207 | | 3 |
| 126–134 | | 2 | 208–220 | | 3 |
| 135–143 | | 1 | | | |

* Twenty of the items are reproduced in Table VII.

† Common logarithms of the times in seconds, rounded to two-place mantissas and multiplied by 100.

least observable in the case of Subject 4. For that subject's raw time distribution, the ratios of $g_1$ and $g_2$ to their standard errors are 3.4 and 2.5, respectively; for the log time, .2 and .1. Only twenty-eight of the sixty-four items in the test were responded to correctly by all four subjects, and, since the items varied greatly in length, comparisons of means and variances cannot be appropriately made.

The distributions in Table III were obtained from a study of the speed of response of thirty high-school girls to thirty CAVD type sentence completion items.* The means and variances of the log times for five of the girls were approximately equal, and the distributions of the five were pooled. The five were enrolled in other than college preparatory curricula, and their IQ's were 97, 100, 102, 107 and 109. The Table contains four fewer than the possible number of scores, due to failures to respond.

Table IV† gives the pooled raw and log time distributions of correct and incorrect response of ten married pairs to thirty CAVD type sentence completion items. (On eleven occasions items were passed without response, and nine of the times fell between 65 and 134 seconds. The nine were deleted for the sake of table compactness.) In terms of percentages failing, the mid-measure of item difficulty was fifteen per cent; the first- and third-quarter measures were five and thirty-five per cent, respectively. The majority of the variances of the twenty log time distributions were acceptably homogeneous, and the means were distributed normally. The pooled log time distributions in Table IV appear to be the sort expected, under the circumstances, in sampling from normal parents. In the distribution of

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* In the administration of the sentence completion items, a screening device which could be slipped down the pages of items was used. In determining a subject's speed of response to an item, the watch was started at the instant the screen came to rest, disclosing the item, and stopped at the instant the subject filled in the last blank of that item.

† I am indebted to Miss Mildred Muench of the Clinton, New York, Central School for the data summarized in Table III and to Mr. J. B. Ellery, now at the University of Colorado, for the data in Table IV. The former had investigated the rôle of speed of response in fifteen pairs of close girl friends; and the latter, its rôle in ten young married couples. The former found the between pair speed variance to be greater than the within pair variance at about the five per cent level of significance; the latter observed significance at about the three per cent level.

TABLE IV.—POOLED DISTRIBUTIONS OF CORRECT AND INCORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF TWENTY ADULTS ON THIRTY SENTENCE COMPLETION ITEMS*

| Time in Seconds | Correct Response | Incorrect Response | Time in† Log Seconds | Correct Response | Incorrect Response |
|---|---|---|---|---|---|
| 2–4 | 56 | | 30–39 | 7 | |
| 5–7 | 91 | 9 | 40–49 | 7 | |
| 8–10 | 108 | 10 | 50–59 | 18 | |
| 11–13 | 66 | 10 | 60–69 | 31 | |
| 14–16 | 50 | 13 | 70–79 | 42 | 5 |
| 17–19 | 29 | 10 | 80–89 | 57 | 5 |
| 20–22 | 20 | 14 | 90–99 | 58 | 6 |
| 23–25 | 15 | 9 | 100–109 | 77 | 9 |
| 26–28 | 7 | 6 | 110–119 | 62 | 14 |
| 29–31 | 7 | 3 | 120–129 | 41 | 17 |
| 32–34 | 3 | 8 | 130–139 | 33 | 16 |
| 35–37 | 4 | 2 | 140–149 | 16 | 12 |
| 38–40 | 4 | 4 | 150–159 | 10 | 11 |
| 41–43 | 2 | | 160–169 | 8 | 8 |
| 44–46 | 4 | 3 | 170–179 | 5 | 5 |
| 47–49 | 1 | 2 | | | |
| 50–52 | 2 | 2 | | | |
| 53–55 | 3 | 3 | | | |

* Twenty of the items are reproduced in Table VII.

† Common logarithms of the times in seconds, rounded to two-place mantissas and multiplied by 100.

log times of correct response, the ratios of $g_1$ and $g_2$ to their standard errors are .9 and .6, respectively. Twenty of the thirty sentence completion items used in the studies from which the data of Tables III and IV were obtained are reproduced in Table VII.

Not only do log times of response to a number of short, homogeneous tasks tend to be distributed normally within the individual; the log times of a number of individuals on a single task tend to be similarly distributed. The samples of individuals at hand are too small to permit adequate examination of the distributions of log times of response to a single item. When the measures from several items having equal mean lengths and

acceptably equal variances are pooled, however, their correspondence to normal form is very evident. The distributions of log and raw times of response of the thirty girls to four such items are shown in Table V. Table VI contains the distributions of the ten married pairs on six items having approximately equal means of log times of correct response. Both tables contain

TABLE V.—DISTRIBUTIONS OF CORRECT AND INCORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF THIRTY HIGH-SCHOOL GIRLS ON FOUR COMPARABLE SENTENCE COMPLETION ITEMS

| Time in Seconds | Correct Response | Incorrect Response | Time in* Log Seconds | Correct Response | Incorrect Response |
|---|---|---|---|---|---|
| 0–8 | 2 | | 70–79 | 1 | |
| 9–17 | 31 | 7 | 80–89 | | |
| 18–26 | 18 | 14 | 90–99 | 2 | 1 |
| 27–35 | 10 | 10 | 100–109 | 8 | 1 |
| 36–44 | 2 | 9 | 110–119 | 12 | 3 |
| 45–53 | 1 | 3 | 120–129 | 14 | 6 |
| 54–62 | | 1 | 130–139 | 10 | 8 |
| 63–71 | 2 | 3 | 140–149 | 10 | 8 |
| 72–80 | | | 150–159 | 5 | 9 |
| 81–89 | | | 160–169 | 2 | 7 |
| 90–98 | | 2 | 170–179 | | 3 |
| 99–107 | | 1 | 180–189 | 2 | 3 |
| 108–116 | 1 | 1 | 190–199 | | 2 |
| | | | 200–209 | 1 | 2 |

* Common logarithms of the times in seconds, rounded to two-place mantissas and multiplied by 100.

fewer than the possible number of scores due to failures to respond.

The various distributions shown in Table I–VI have been selected as representative of the many possible distributions afforded by the samples of individuals and tasks in hand. They support the hypotheses that (1) times of response to mental test items, measured in log seconds, tend to be normally distributed in the individual and (2) times of response on a single item, measured in log seconds, tend to be normally distributed in a

TABLE VI.—DISTRIBUTIONS OF CORRECT AND INCORRECT RESPONSE TIMES IN SECONDS AND LOG SECONDS OF TWENTY ADULTS ON SIX COMPARABLE SENTENCE COMPLETION ITEMS

| Time in Seconds | Correct Response | Incorrect Response | Time in* Log Seconds | Correct Response | Incorrect Response |
|---|---|---|---|---|---|
| 5–9 | 6 | | 77–85 | 2 | |
| 10–14 | 23 | 5 | 86–94 | 3 | |
| 15–19 | 14 | 6 | 95–103 | 7 | 1 |
| 20–24 | 12 | 8 | 104–112 | 11 | 2 |
| 25–29 | 5 | 7 | 113–121 | 14 | 3 |
| 30–34 | 4 | 5 | 122–130 | 8 | 6 |
| 35–39 | 2 | 5 | 131–139 | 11 | 7 |
| 40–44 | 3 | | 140–148 | 6 | 8 |
| 45–49 | 3 | 4 | 149–157 | 4 | 7 |
| 50–54 | | | 158–166 | 5 | 3 |
| 55–59 | 1 | | 167–175 | 2 | 3 |
| 60–64 | | 4 | 176–184 | | 4 |
| 65–69 | | | 185–193 | | 1 |
| 70–74 | | 1 | | | |

* Common logarithms of the times in seconds, rounded to two place mantissas and multiplied by 100.

group of individuals. The distributions of response times to sentence completion items have been utilized only in order to compare different samples of individuals. The writer[5] found speed, measured in log seconds, in arithmetic reasoning and in number series completion to be slightly better distributed with regard to normality and homogeneity and to discriminate between individuals in a sample of thirty-six more sharply than speed in sentence completion. The former two have the additional advantage of being easily scored for accuracy on an all-or-none basis.

The converse of a theorem that the distribution formed by pooling samples from a normal universe is normal would not necessarily hold. But where there are no systematic differences with respect to normality between the samples, it is reasonable to suppose that the variable is distributed normally in the populations sampled.

The hypotheses appear to obtain for a wide variety of tasks from zero to at least about sixty per cent difficulty, defined by percentages failing, and for a wide variety of individuals who are striving for both speed and accuracy in their performance. Performances on tests, however scored, obviously are affected by the individuals and the tasks, but in view of the variety of individuals and tasks here under consideration, it appears likely that log time will prove a generally useful unit in measuring speed of response.

## CONTROL OF ACCURACY

Given appropriate tasks and units of measurement, the next requirement of a study of mental speed is provision for control of inaccuracy effect, which, the data of Tables III–VII indicate, tends to be substantial.

If two or more individuals respond to the same tasks with the same degree of accuracy, their rates of work can be compared simply and precisely. This ideal situation can be made to obtain by retaining for an analysis only the response times on tasks which all subjects perform correctly. Such experimental control, though the soundest possible, has two disadvantages. First, in practical situations, it is likely to result in enormous loss of data. For example, thirty-six of the sixty-four Minnesota Form Board items would be lost if the data of Table II were limited to items which all four subjects performed correctly. Second, since such tasks are of zero difficulty, they cannot be shown to be measuring anything except speed. Measures based upon them provide no information regarding rate of doing various kinds of work of varying degrees of difficulty.

There are several statistical methods of controlling accuracy effect, at least two of which merit consideration. If approximately equal length tasks, on an average, are available, such that all of the individuals in a sample perform two or more correctly and two or more incorrectly (the more, of course, the better), a precise statistical control is possible. In this situation, mean times of correct and of incorrect response may be computed and classified for conventional analysis of variation. The simplest classification would be a two array table and would permit tests of significance of accuracy and individual effects on mental speed in a particular function. Various extensions of

the design suggest themselves. If the tasks can be classified according to two or more levels of difficulty or two or more functions or two or more experimental treatments, a four or more array classification of the speed scores can be made. It will be noted that, provided the log times can be shown to be distributed normally with equal variance, the assumptions underlying variance analysis will be explicitly fulfilled.

A second method of controlling accuracy effect consists in adjusting each response time or speed score for accuracy by regression procedure. In a single task, accuracy being scored '0' or '1,' the residuals from the regression line of speed on accuracy will be merely the difference between the scores and the mean of correct or of incorrect response, as the case may be. There will result as many residual or adjusted scores for each individual as there are tasks; and the mean of these will provide an unbiased estimate of the individual's speed of response free from task and accuracy effects. This method, which the writer has more fully described elsewhere,[5] has the advantage of not obscuring the variability of the original measures, of providing control of possible systematic differences in length of task, and of providing a single measure of individual speed. Because of the latter advantage, the method will be particularly useful in studying mental speed correlatives.

The question of whether speeds of correct and of incorrect response are homogeneous in an individual is an important and interesting one. Theoretical considerations suggest that if a task were unintelligible to an individual, the time of his response would have little meaning. They also suggest that different sorts of inaccuracies or errors will affect response times differently. Empirically, the speeds do appear to possess homogeneity. The evidence indicates consistency in rates of correct and of incorrect response, in general, i.e., individuals tend to maintain their relative positions in rate regardless of accuracy, although there may be significant individual differences here, and, as a speculation, these may be important.

## THE RELIABILITY OF SPEED MEASURES

Both of the above methods of statistical control of accuracy make it possible to determine whether the variation in speed of response between individuals is significantly greater than the

variation within individuals. The first method, however, since it utilizes the means of correct and incorrect response times, obscures the variability of the original measures. It is possible that significance of differences in speed demonstrated by the method would not obtain if the original measures were given freer play.

The second method provides the data for testing the significance of differences between estimated true speeds of response, with the criterion or error variance, since it is the pooled variances of the adjusted scores within individuals, at a maximum. (It should be noted that the application of the method results in the loss of two degrees of freedom per item.) The test of reliability here is the simple one of determining whether the variation of the means of the adjusted scores is significantly greater than the variation of the scores within individuals, the assumptions being those of normality and of homogeneity of error variance. In his examination of sixteen sets of adjusted speed measures, the writer has found the first assumption generally tenable. The second assumption has generally been in doubt, although not sufficiently to invalidate variance-ratio tests. It appears probable that there are significant and possibly important individual differences in variability in mental speed. The possibility invites further investigation.

The second method also makes it possible to estimate the reliability of single items. The correlation of adjusted times on an item with aggregate adjusted times on the remaining items will provide an index of the discriminating power or the reliability of the item as a measure of speed.

The twenty sentence completion items entered in Table VII were common to the studies of mental speed in the three samples of individuals mentioned above. The samples differed in several respects. The median IQ in the sample of thirty-six, consisting of twenty-two boys and fourteen girls, was 116. The boys and girls were enrolled in a college preparatory curriculum and all were of relatively favorable socio-economic background. The median IQ in the sample of thirty girls was 110. The girls were of diverse socio-economic backgrounds and were enrolled in various curricula. The males of the sample of twenty adults, consisting of ten married pairs, were above the 60 percentile for college students on the Henmon-Nelson mental test and were

enrolled in a highly selective men's liberal arts college. All were veterans. Nine of the ten wives had two or more years of college training, and all appeared to be of average or better intelligence among college women.

Space does not permit inclusion of the log time and accuracy scores of each individual on each item, but the statistics derived from them are shown in Table VII. A rough estimate of the standard deviations of the log times of correct and of incorrect response, from which the means in the table were derived, indicated that they fell between about 15 and 35. The standard errors of the means, consequently, range from about 2 upward, with the great majority lying between 5 and 10. Reliable differences in both speed and altitude are indicated between the populations of high-school students and the population of adults represented by the samples. The differences between the populations of high-school students approach significance on few items, although the sample of thirty has a mean cumulative accuracy score on the twenty items of 12.2 against a mean of 13.7 for the sample of thirty-six. The difference is about 2.5 times its standard error.

The extent of correspondence of the ways the items worked in the three samples is interesting. Considering the samples of thirty and thirty-six, the rank-difference correlation coefficients between mean log times of correct response, between mean log times of incorrect response, and between item difficulties are .86, .75, and .76, respectively. For the samples of thirty and twenty, the coefficients between mean log times of correct response and between item difficulties are .85 and .72. For the samples of thirty-six and twenty, the coefficients between mean log times of correct response and between item difficulties are .93 and .80.

The item reliability coefficients shown in Table VII were determined by rank-difference correlation of adjusted times on each item with total adjusted times on the twenty items. The majority of the coefficients in the two samples of high-school students are significant. The differences between coefficients in the two samples are such as would be expected in sampling. Only item 15 raises doubt. There, taking into account the loss of two degrees of freedom, the null hypothesis is discredited at about the three per cent level. In the sample of adults fewer

TABLE VII.—MEAN LOG TIMES OF CORRECT AND INCORRECT RESPONSES, DIFFICULTY AND RELIABILITY OF EACH OF TWENTY SENTENCE COMPLETION ITEMS FOR THREE SAMPLES OF INDIVIDUALS

| Sentence | Sample of Thirty High-school Girls | | | | Sample of Thirty-six High-school Girls and Boys | | | | Sample of Twenty Young Adults | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Correct Response | Incorrect Response | Per Cent Failing | Reliability | Correct Response | Incorrect Response | Per Cent Failing | Reliability | Correct Response | Incorrect Response | Per Cent Failing | Reliability |
| 1. Two pounds of silver are ____ more than two pounds of iron. | 81 | 128 | 33 | .36 | 86 | 100 | 33 | .55 | 71 | 104 | 10 | .14 |
| 2. It ____ strength to ____ a heavy weight. | 97 | 115 | 30 | .12 | 100 | 131 | 39 | .45 | 79 | 118 | 20 | .09 |
| *3. We are bound to ____ if every one does his ____. | 98 | 117 | 40 | .47 | 99 | 102 | 14 | .65 | 83 | 94 | 5 | .08 |
| *4. Rich and ____ alike are seldom happy without good ____. | 109 | 132 | 10 | .36 | 101 | 116 | 17 | .33 | 83 | — | 0 | .30 |
| 5. A body of ____ entirely surrounded by ____ is called a ____. | 110 | 142 | 27 | .39 | 114 | 148 | 22 | .38 | 103 | 117 | 15 | .63 |
| 6. It may ____ effort and a long ____, but the result is sure. | 112 | 119 | 27 | .62 | 112 | 138 | 36 | .38 | 90 | 114 | 30 | .54 |
| *7. A ____ is judged by the ____ he ____. | 115 | 155 | 7 | .52 | 108 | 128 | 11 | .62 | 87 | — | 0 | .50 |
| 8. There is no ____ on earth ____ cannot bear ____ misfortune. | 120 | 145 | 33 | .39 | 114 | 126 | 11 | .56 | 108 | — | 0 | .62 |
| *9. Time ____ ____ worth more ____ money. | 123 | 161 | 40 | .37 | 138 | 161 | 36 | .34 | 122 | 136 | 25 | .33 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *10. You may ____ some of the questions even though you are not certain your ____ are ____. | 125 | 123 | 23 | .65 | 129 | 143 | 31 | .61 | 111 | — | 0 | .48 |
| *11. Poverty cannot ____ a man ____ is intelligent and who ____ hard. | 125 | 150 | 20 | .49 | 122 | 149 | 11 | .62 | 119 | 178 | 10 | .59 |
| 12. Many new ____ are printed every year, but some wise ____ prefer to ____ the old ones. | 128 | 140 | 20 | .65 | 128 | 136 | 22 | .75 | 105 | 167 | 5 | .63 |
| 13. The leader was unjustly ____ by those who, in his place, would have probably ____ no differently. | 130 | 141 | 47 | .62 | 121 | 137 | 39 | .63 | 99 | 105 | 5 | .06 |
| 14. Most men ____ themselves ____ more kindly than their ____ judge them. | 130 | 152 | 50 | .43 | 143 | 140 | 39 | .29 | 126 | 119 | 35 | .56 |
| 15. She left a ____ for the people whom she thought would ____ during her ____. | 134 | 161 | 40 | .72 | 140 | 148 | 53 | .31 | 120 | 155 | 25 | .24 |
| 16. ____ spite ____ many severe ____ he is still alive ____ the ____ of ninety-one. | 135 | 174 | 43 | .51 | 137 | 152 | 28 | .73 | 125 | 150 | 10 | .09 |
| 17. He will do as you request ____ ____ his own feelings. | 137 | 137 | 90 | .41 | 138 | 135 | 42 | .39 | 122 | 131 | 35 | .42 |
| 18. As ____ the treasure he had come to seek, probably it existed ____ in his own ____. | 141 | 175 | 67 | .54 | 135 | 168 | 64 | .47 | 109 | 143 | 45 | .13 |
| 19. No ____ is powerful ____ to ____ two and two be five. | 142 | 163 | 50 | .27 | 130 | 153 | 42 | .38 | 131 | 153 | 55 | .65 |
| 20. If ____ the ____ of the year were holidays, playing ____ be ____ tedious ____ working. | 154 | 176 | 63 | .60 | 156 | 171 | 44 | .45 | 143 | 157 | 35 | .41 |

* Only sentences 3, 4, 7, 9, 10, and 11 were constructed for the three studies. The other sentences were taken from Thorndike's lists.[6]

than half of the coefficients appear to be significant, and several coefficients indicate significant differences between the population of adults and the populations of high-school students. All in all, however, the data of Table VII indicate that item times are at least as stable as item difficulties. In sentence completion, at least, the possibility of developing quite reliable speed measures and norms appears promising.

## SUMMARY

In this paper several questions relating to the rôle of mental speed in behavior have been raised, and a method of obtaining normally distributed measures of speed has been proposed. Considerable evidence has been presented in support of the hypotheses that (1) times of response to mental test items, measured in log seconds, tend to be normally distributed in the individual and (2) times of response on a single item, measured in log seconds, tends to be normally distributed in a group of individuals. Two statistical methods of controlling accuracy have been suggested. The extent of the stability and consistency of speed of response to sentence completion items for three samples of individuals has been briefly described.

## REFERENCES

1) Brent Baxter, "An Experimental Analysis of the Contributions of Speed and Level in an Intelligence Test," *Journal of Educational Psychology*, 32:285–96, 1941.

2) W. M. Davidson and J. B. Carroll, "Speed and Level Components in Time-limit Scores: A Factor Analysis," *Educational and Psychological Measurement*, 5:411–27, 1945.

3) R. A. Fisher, *Statistical Methods for Research Workers*, London: Oliver and Boyd, 8th Edition, 1941, pp. 50–52.

4) Helen Peak and E. G. Boring, "The Factor of Speed in Intelligence," *Journal of Experimental Psychology*, 9:71–94, 1926.

5) Merle W. Tate, *Individual Differences in Speed of Response in Mental Test Materials of Varying Degrees of Difficulty*, Unpublished Doctor's Dissertation, Cambridge: Harvard University, 1947. (See Vol. 8, pp. 353–374, *Educational and Psychological Measurement*, for a digest of the dissertation.)

6) E. L. Thorndike, *Measurement of Intelligence*, New York: Bureau of Publications, Teachers College, Columbia University, 1926.

# GAINS IN SCHOLASTIC APTITUDE UNDER HIGHLY MOTIVATED CONDITIONS

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Results of an experimental sixteen-week intensive training program for adult servicemen showing change in scholastic aptitude seem worth while adding to the increasing amount of evidence concerning the constancy and change of scholastic intelligence. At present the majority of studies have used data on students of school and college age, but have not found adult groups as accessible for retesting. The study has bearing on two issues in educational psychology. (1) Does scholastic intelligence as measured by tests stop growing at age sixteen, in the early twenties, or later? (2) How great a change would highly motivated schooling make in the scholastic intelligence of young adults?

On the latter issue, data on mountain, gypsy, and canal boat children, who are educationally isolated, have revealed a drop of over twenty-five IQ points or about one hundred sixty scaled score points* in an eight- or nine-year period. Soldiers of World War I from educationally backward states had a lower IQ than did soldiers from states with advanced educational systems. Children adopted into favorable foster homes also show an average increase of about five IQ points. These facts have led Bingham to conclude that "there can be scarcely any doubt today that schooling and other educative experiences tend to increase a child's intelligence." Can adults improve their scholastic intelligence under favorable conditions even after they are twenty years old?

In this study, scholastic intelligence is measured by the ACE Psychological examination and high motivation took place during Navy Pre-Midshipmen Refresher Program at Colgate University. The purpose of the program was to give enlisted men with an average of three years' college training an opportunity of completing midshipmen's training on an equitable basis with other officers candidates who had completed college

* In this paper one hundred scaled score points equal 1.00 SD and sixteen IQ points equal 1.00 SD.

work. Such men were recommended as candidates for this V-7 program by the captains of their ships or by their shore-based commanding officers. Every one wanted to become an officer and knew that by completing the refresher program and by passing his sixteen weeks' training in Midshipmen's School he definitely would be made an officer. Here an opportunity for up-grading was given in which both the goal and the steps to reach it were defined. It was Colgate's task to see that each man's aptitudes and achievements were so appraised that he could be given training at the proper speed and level. Some men would need sixteen weeks of refresher work; some, eight weeks; and few would be able to go on immediately. The refresher course consisted of English, mathematics, engineering drawing and physics and physical training. In an eight or sixteen weeks' course, a man had to take a full year's work in physics, mathematics, algebra, trigonometry, and navigation and a full year's work in English and an equivalent of a full year's work in engineering drawing. Physical training and drill were added, so that all the waking hours of a man's time on week days were completely consumed.

Evidence from two sets of interviews indicates that the drive to succeed was very strong. A new group entered each month starting in July, 1944, through September, 1945. At the time of entrance each man was given the 1941 Edition of the ACE Psychological Examination and other tests. Those who were to remain in the program sixteen weeks, actually seventy-five per cent of the total, were given the 1942 Edition of the Psychological Examination after twelve weeks. These editions according to the norms were nearly comparable and were constructed as equivalent forms. The norms show that the 1942 edition actually is four points or seven percentiles more difficult, so that actual change is greater than apparent change in raw score.

A description of the nature of the population will be important for later interpretation. The men were 24.5 years of age, had been out of college about 3.2 years after going to college at least two and an average of approximately three years. Fifty-two per cent were men with overseas duty. Most of the remainder had transferred from an Air Cadet (V-5) program. They came from all forty-eight states with the largest portion, ten per cent,

having attended high school in New York State. Next ranking states were California, Illinois, Pennsylvania and Texas, respectively. A sample was slightly below average in scholastic intelligence for college freshmen (40th percentile) at the time of initial entrance to college six years earlier. [Data on thirty-six men for whom comparable earlier tests were available are presented in the third succeeding paragraph.]

For purposes of this study, five classes from September, 1944, to January, 1945, inclusive were selected to determine whether any unusual gain in scholastic aptitude was to be found. Table I shows that for these two hundred sixty-one men the average gain was from the 56th percentile to the 78th percentile, or a gain of twenty-two percentiles. Every one of the five groups gained more than twenty percentiles. At the time of entrance the average score for the groups was 110.7 and at the close of the twelve-week period the score was 125.7. This difference is over seven times what might be expected from chance (CR = 7.1).

TABLE I.—PRETEST AND RETEST RESULTS ON THE ACE PSYCHOLOGICAL EXAMINATION IN A TWELVE-WEEK PERIOD

| Group | N | Pretest Average | Retest Average | Raw Score Gain | Pretest SD | Retest SD |
|---|---|---|---|---|---|---|
| Total | 261 | 110.66 | 125.70 | 15.04 | 22.98 | 22.08 |
| A | 40 | 104.90 | 122.60 | 17.70 | 21.18 | 21.00 |
| B | 54 | 112.40 | 127.04 | 14.64 | 19.08 | 19.56 |
| C | 53 | 110.84 | 125.54 | 14.70 | 23.28 | 23.88 |
| D | 51 | 109.04 | 122.54 | 13.50 | 20.94 | 18.96 |
| E | 63 | 114.08 | 129.20 | 15.12 | 24.62 | 23.82 |

At the same time the men remained in relatively the same position with respect to each other. This is indicated by a correlation of .88 between the pretest scores and the retest scores of the two hundred sixty-one men—a coefficient which is almost as high as the reliability of the test, even though it includes a twelve-week lapse of time.

It was thought possible that the gain might be due to loss of scholastic aptitude during their several years of service with the fleet and that this increase represented a return to their normal score. To test this, letters were sent to their earlier colleges for

the classes entering in September, 1944, and November, 1944, to obtain scholastic aptitude scores given at the time of entrance to college. Thirty-six of these returns were such that results could be directly compared to the later pretest results. The raw score mean for the thirty-six men at the time of college entrance was 94.9, their mean at the time of pretest was 108.4, and their mean at the time of retest was 122.2. Thus, over a period of about six years they had gained thirteen and one-half raw score points or sixty scaled score points. Whether this is lower than normal growth cannot be answered, but there is some evidence to show that greater mental growth should be expected during the four college years.[1] The sample appears to be about two or three points lower in scholastic intelligence than the large group.

There are several possible factors that may account for some of the gain of the large group: (1) practice effect, (2) regression if below average individuals are used, (3) normal growth during the twelve weeks, (4) genuine growth in mental alertness during the refresher program. The practice effect of retaking CEEB scholastic verbal aptitude test is a gain of about twenty scaled score points, even though different forms are used.[2] It seems reasonable to assume, then, that the effect of such practice on the ACE Psychological Examination accounts for not more than about twenty of the sixty-eight scaled score points gained by the V-7 men.

The amount of change due to regression, the second factor, should be negligible, for the sample indicated that the large group averaged between the 40th and 45th percentile according to national norms at the time they entered college. Likewise the change due to normal growth, factor three, during the three-month period should be very small. One study showed the growth to be about ten scaled points for three months for seventeen and eighteen year olds.[2] Normal growth at the average age of twenty-five is probably less than this. If ten scaled points are assigned to the influences of both the second and third factors a genuine growth of thirty-eight scaled score points or a

[1] T. M. Livesay, "Does Test Intelligence Increase at the College Level," *Journal of Educational Psychology*, Volume 30, 1939, pp. 63–68.

[2] Richardson, Pearson, "Effects of Growth and Retesting on SAT Verbal Scores," *The College Board Review*, Vol. I, No. 5, Fall, 1948, pp. 57–71.

gain of eleven percentiles may be attributed to the special educational experience.

The question of shift in rank in scholastic aptitude also has significance for guidance. In the sample group of this study the correlation between earlier entering college scores and pretest score was .60. (The correlation between pretest and retest has already been reported to be .88). Another study has shown the correlation during a nine-year adolescent period to be about .50.[3] These two correlation coefficients are in relative agreement. If substantiated by other studies, they suggest that there may be considerable shifting in the relative rank of young adults in scholastic aptitude. Test scores of entering freshmen may be only moderately predictive of senior or adult scholastic intelligence.

## CONCLUSIONS

1) An average gain of twenty-two percentiles (sixty-eight scaled score points) in scholastic aptitude over a twelve-week period was consistently shown by five classes in which the average age was 24.5 years.

2) About half of this gain might be accounted for by practice effect, regression and maturation, but a significant average gain of at least eleven percentiles or thirty-eight scaled score points still remained which may be attributed to the effects of the training program.

## IMPLICATIONS

1) Counselors of freshmen can encourage freshmen who rank below average in scholastic intelligence. Under the right motivation and working conditions whole groups can increase their tested scholastic intelligence by twenty-two percentiles. Many individuals can do better; some may do worse.

2) The entering freshman's scholastic intelligence percentile seems to remain very stable in a relative sense over a three month's period, but it may fluctuate over a period of years sufficiently to make the retesting desirable for graduate schools or for industries that use scholastic intelligence as one of several selection devices.

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[3] H. E. Jones, and H. S. Conrad, "Mental Development in Adolescence," *43rd Yearbook*, The National Society for the Study of Education, Part I, p. 159.

COMMENTS

Interpretation in this study is admittedly conservative. The practice effect on the ACE Psychological Examination may be less than the twenty scaled points of the SAT Verbal Examination, because of the practice exercises in the former. Also if the four raw score or eighteen scale score points due to the greater difficulty of the 1942 edition were added to the apparent gain, the change during the twelve-week intensive educational program would be even more impressive.

# INTERGROUP ATTITUDES OF GENTILE, JEWISH, AND APACHE INDIAN CHILDREN

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The purpose of this study is to present the intergroup attitudes of Gentile, Jewish, Apache Indian, Seventh Day Adventist, delinquent, rural, and city children, as expressed on the Zeligs Intergroup Attitudes Test.

## THE SUBJECTS

The subjects of this study were one hundred sixty-three Jewish, thirty Protestant, and seven Negro twelve-year-old children studied in 1931; who attended the AV suburban public school in Cincinnati, Ohio; one hundred fifty Jewish, thirty-three Protestant, and nine Negro twelve-year-old children who attended the same school in 1935; one hundred fifty Jewish, twenty Protestant, and four Negro twelve-year-old children who attended the same school in 1944; forty-two Protestant twelve-year-old children studied in 1935 who attended the PR public suburban school in Cincinnati, Ohio; one hundred thirty-seven Apache Indian children ranging from thirteen to seventeen years in age, from Whiteriver, Arizona, studied in 1934; fifty-nine Cincinnati high-school students; forty-six rural northern Ohio high-school students; twenty-three delinquent girls; and eleven Seventh Day Adventist children, studied in 1944.

## TECHNIQUES AND PROCEDURES

The children were given the Zeligs Intergroup Attitudes Test which requires the subjects to indicate their willingness to accept members of each of thirty-nine races and nationalities for the relationships of cousin, chum, roommate, playmate, neighbor, classmate, and schoolmate, by writing 'yes' for the relationship and to express their unwillingness by writing 'no' for the relationship indicated. The index of friendliness was computed by adding the 'yes's' expressed by all the subjects towards each race and nationality and computing its percentage of the total possible number of 'yes's.' The total number of 'yes's' on the entire test was used as the child's score in intergroup friendliness.

## THE FINDINGS

In 1931 the Gentile children of the AV. School scored somewhat higher on the Intergroup Attitudes Test than the Jewish children, having an average score of 124 as against 117. In 1935 the Jewish children scored 125 as against 107 for the Gentile children of the AV. School and 134 for the Gentile children of the PR. school. The average of 121 for all the Gentile children studied in 1935 indicates little difference between the Gentile and Jewish children in tolerance. The average score for the boys these various times was always somewhat higher than for the girls. The Apache American Indian children of Whiteriver, Arizona, studied in 1934, whose average was 96, scored significantly lower than the twelve-year-old Cincinnati children.

The social distance the children expressed for the different relationships shows that 'cousin' and 'roommate' are considered the most intimate relationships by all the groups studied. In 1931 the Jewish children were more particular than the Gentile children for those relationships, but in 1935 the Gentiles were more particular. In 1935 the difference between 'cousin' and 'chum' was the same for both groups of the AV. School. The PR. School children were slightly more particular about 'roommate' than 'cousin.' The difference between 'cousin' and 'chum' was less for these children than for those of the AV. School. The Jewish children tend to make more definite differentiation than the Gentile children between the most distant and least distant relationship. The Indian children expressed less difference than the white children between these relationships.

Table 1 gives the degree of friendliness toward thirty-nine races and nationalities expressed by the twelve-year-old children in 1931 and 1935, and by the Indian children in 1934. All groups except the Indian children ranked American first. The Indian children ranked American second. In 1931 the Jewish children ranked German Jew second. American, English, Dutch, Irish, American Indian, Canadian, French, and German, were ranked high by most of the groups, while Finn, Roumanian, Hindu, Bulgarian, Mulatto, Bohemian, Syrian, Negro, Servian, and Armenian were ranked low. The Jewish children tested in 1931 showed slightly less favor than those tested in 1935 towards American Indian, French-Canadian, Italian, Mexican, Czechoslovakian, and Finn. The 1935 Jewish subjects showed greater

TABLE 1.—INDEX OF FRIENDLINESS TOWARD RACES AND NATIONALITIES EXPRESSED BY TWELVE-YEAR-OLD JEWISH AND GENTILE CHILDREN AND BY APACHE AMERICAN INDIAN CHILDREN. [EXPRESSED IN PERCENTAGE.]

| | 1931 | | 1935 | | 1935 PR. School Gentile | 1935 AV. & PR. School Gentile | 1934 Apache Indian |
|---|---|---|---|---|---|---|---|
| | AV. School | | Jew | Gentile | | | |
| | Jew | Gentile | | | | | |
| American | 96 | 99 | 97 | 100 | 100 | 100 | 85 |
| English | 81 | 89 | 84 | 84 | 95 | 90 | 65 |
| Irish | 53 | 70 | 53 | 61 | 77 | 70 | 48 |
| Dutch | 68 | 72 | 64 | 57 | 76 | 68 | 55 |
| American Indian | 50 | 61 | 57 | 60 | 74 | 67 | 89 |
| Canadian | 69 | 64 | 61 | 40 | 73 | 58 | 29 |
| French | 72 | 85 | 71 | 60 | 71 | 66 | 42 |
| Scotch | 45 | 58 | 49 | 43 | 70 | 58 | 38 |
| French-Canadian | 44 | 50 | 52 | 35 | 66 | 52 | 33 |
| Swedish | 51 | 60 | 50 | 43 | 65 | 55 | 30 |
| German | 63 | 77 | 36 | 51 | 63 | 57 | 36 |
| Italian | 41 | 47 | 50 | 48 | 62 | 56 | 41 |
| Dane | 36 | 37 | 40 | 40 | 60 | 49 | 17 |
| Japanese | 51 | 62 | 48 | 36 | 60 | 49 | 46 |
| Norwegian | 49 | 56 | 48 | 42 | 59 | 51 | 22 |
| Polish | 54 | 34 | 54 | 33 | 58 | 47 | 25 |
| Mexican | 42 | 51 | 50 | 34 | 57 | 47 | 52 |
| Spanish | 48 | 56 | 52 | 49 | 55 | 52 | 45 |
| Filipino | 35 | 52 | 42 | 23 | 53 | 40 | 33 |
| German Jew | 85 | 61 | 77 | 39 | 46 | 43 | 36 |
| Russian | 58 | 41 | 59 | 37 | 45 | 42 | 38 |
| Greek | 44 | 48 | 47 | 45 | 45 | 45 | 32 |
| Turk | 33 | 36 | 39 | 28 | 44 | 37 | 37 |
| Chinese | 36 | 39 | 42 | 32 | 44 | 39 | 35 |
| Portuguese | 29 | 28 | 39 | 18 | 44 | 32 | 27 |
| Arab | 24 | 32 | 30 | 25 | 44 | 35 | 24 |
| Hungarian | 37 | 40 | 40 | 31 | 41 | 37 | 26 |
| Czechoslovakian | 30 | 35 | 42 | 29 | 41 | 37 | 28 |
| Russian Jew | 80 | 50 | 77 | 37 | 39 | 38 | 27 |
| Finn | 17 | 34 | 35 | 19 | 37 | 29 | 28 |
| Roumanian | 38 | 24 | 40 | 21 | 34 | 28 | 18 |
| Hindu | 22 | 21 | 26 | 16 | 32 | 25 | 17 |
| Bulgarian | 31 | 29 | 37 | 30 | 31 | 30 | 25 |
| Mulatto | 10 | 9 | 10 | 5 | 26 | 16 | 24 |
| Bohemian | 13 | 15 | 20 | 12 | 20 | 16 | 18 |
| Syrian | 12 | 8 | 19 | 14 | 20 | 17 | 18 |
| Negro | 18 | 20 | 21 | 13 | 15 | 14 | 28 |
| Servian | 11 | 11 | 17 | 12 | 12 | 12 | 18 |
| Armenian | 11 | 10 | 11 | 11 | 11 | 12 | 26 |

antipathy towards the Germans, assigning them twenty-ninth place as against the eighth place given by the group tested earlier. The Gentile children of the AV. groups, tested in 1931, showed greater favor than the 1935 group towards the Canadians, Germans, Japanese, Mexicans, Filipino, and German Jew, and less favor towards the Spanish.

A comparison of the 1935 Gentiles of the AV. School with those of the PR. School indicates more favorable attitudes by the AV. subjects towards the French, Germans, and Italians, and greater antipathy towards the Scotch, Canadians, French-Canadians, Japanese, Polish, Mexican, Filipino, and Portuguese. The Gentile children of the AV. School, who came in contact with many Jewish children, show more favor towards German and Russian Jews than the Gentile children of the PR. School where no Jewish children were enrolled.

Comparing the Jewish with the Gentile children of both schools, the Jewish children show much more favor towards German Jews and Russian Jews, Russian, and Polish, while the Gentiles favor the Irish, Scotch, German, and American Indian. In General, these reactions are in keeping with the ethnic background of the children.

Comparing the Indian with the Gentile children, differences represent more favorable attitudes of the Indian children towards the Japanese, Mexicans, Spanish, German Jew, Turk, Chinese, and Negro, and less favorable attitudes towards the French-Canadian, Swedish, German, Dane, Norwegian, and Polish. Many of these differences may be explained by the ethnic backgrounds and contacts of the children. There was close agreement between the two groups in their attitudes toward the other twenty-six races and nationalities on the test.

There seems to be a general pattern among all the groups. This pattern tends to favor the North European peoples with special ranking for the English, Irish, Dutch, Canadian, French, Scotch, French-Canadian, Swedish, German, and Italian. This cultural pattern of group prejudice is similar to that of college students studied by Thurston[2] and of adults studied by Bogardus.[1]

In 1944 the test was given to city high-school students, rural high-school students, delinquent girls, and Seventh Day Adventist adolescent children. The city high-school students, with an average score of 169, were the highest. Then came the sixth-

grade children with an average of 160, the Seventh Day Adventists with an average score of 151, and the rural high-school students with an average of 144. The delinquent girls with an average score of 117 were much lower than the other four groups. It is possible that this low score is due to lack of knowledge about some of the races and nationalities rather than to unfavorable attitudes. These girls were low in intelligence, their intelligence quotients being between 80 and 90.

The social distance expressed for the different relationships showed that all five groups ranked cousin first, roommate second, and chum third. The sixth-grade and the city high-school students were more particular about neighbor than were the rural high-school students, the Seventh Day Adventists, and the delinquent girls. The difference between the most intimate and least intimate relationship was forty per cent for the sixth grade; thirty-eight per cent for the city high-school students; thirty-five per cent for the rural high-school students; forty-six per cent for the Seventh Day Adventists, and fifteen per cent for the delinquent girls.

The ranking of the thirty-nine races and nationalities were noted. All five groups ranked American first. The races and nationalities towards which the highest degree of friendliness were expressed in 1944 were American, English, Canadian, Hawaiian, South American, Irish, French, Australian, American Indian, and Dutch. At the bottom of the list, showing the least friendliness expressed towards them, were German, Dane, Bulgarian, Negro, Roumanian, Portuguese, Arab, Finn, Japanese, Hindu, Albanian, and Mulatto.

There was close agreement among all five groups in their attitudes toward American, English, Dutch, Norwegian, Roumanian, and Albanian. Four of the five groups showed close agreement in their attitudes toward Canadian, South American, Hawaiian, Chinese, Irish, Australian, Swiss, Spanish, Greek, Polish, French-Canadian, Italian, Czechoslovakian, Hungarian, Bulgarian, Negro, Portuguese, Arab, Finn, Japanese, Hindu, and Mulatto.

The Seventh Day Adventists were more favorable toward the Jews than were the high-school students or the delinquent girls. Some of the differences may be explained by the racial and national background of the subjects. Except that the present subjects rank German and Japanese much lower, and Russian

and Chinese higher than in earlier studies,[3] the general pattern of the five groups is similar to the attitudes of children studied before 1944. The large number of Jewish children in the sixth grade of the AV. School and of Negro children among the delinquent girls studied explains the high ranks given the Jew and Negro by those subjects. In most other cases there is much agreement among the five groups in their attitudes.

## SUMMARY

The trend in children's attitudes is definitely toward better understanding. With the exception that children show more favor towards their own racial, religious, or national group, the general pattern of likes and dislikes expressed by the Jewish, Gentile, and Indian children is very similar. Gentile children who came in contact with Jewish children showed more favor towards Jews than those who had few contacts with them. The war undoubtedly made children more conscious of their attitudes. Where formerly the tendency was to favor those who were like them in color and culture, such as the North Europeans, the trend changed towards favoring allies, regardless of other factors. Although the children do feel closer to people who are similar to Americans in color, culture, and language, the trend is towards a wider outlook. The Germans were disliked while the Chinese and Filipinos were admired as friends and allies. There was little difference in the scores of the sixth-grade and high-school students. The rural children scored somewhat lower than the city children. The children studied in 1944 were less afraid of differences in race or culture than the children studied earlier.

## REFERENCES

1) E. S. Bogardus, *Immigration and Race Attitudes.* New York: D. C. Heath and Co., 1928, p. 268.

2) L. L. Thurstone, "An Experimental Study of Nationality Preferences." *Journal of General Psychology*, 1928, 1, 405–425.

3) Rose Zeligs, "Children's intergroup attitudes." *The Journal of Genetic Psychology*, 1948, 72, 101–110.

# BOOK REVIEWS

PALMER O. JOHNSON. *Statistical Methods in Research.* New York: Prentice-Hall, Inc., 1949, pp. 377.

With the increasing use of statistical techniques in research, greater emphasis must necessarily be placed on the interpretative function of statistics. The statistician needs to know more than how to collect and describe large masses of data. In recognition of this need, Dr. Johnson has prepared a book which stresses understanding of the theoretical bases and the underlying assumptions of methods used by the research worker. His stated aim is to supply students with a book built on the recent advances in theory and practice pertaining to the problems of testing statistical hypotheses and of statistical estimation.

Those who are particularly interested in psychology and in education will be pleased to note in the preface that "the book . . . was developed . . . primarily for graduate students in education and in psychology." It is also reassuring to find on page 14 the statement that the book "is written for readers without specialized mathematical training." But despite these statements and the fact that *Statistical Methods in Research* is a scholarly work which includes a considerable number of illustrative applications of principles, it is generally not suitable as a text for graduate students in psychology and education.

The book begins with a discussion of probability and likelihood. This is followed by sampling distributions and the building up of statistical models against which experimental results may be checked, e.g., the normal distribution, t, and chi-square. A short and heavy discussion of the general theory of testing statistical hypotheses leads into a long chapter devoted to current procedures. Illustrative problems demonstrate the use of various tests of significance. Chapter VI is entitled "The Estimation of Population Parameters." This includes a concentrated theoretical treatment of estimation (point estimation and estimation by interval, fiducial limits and confidence intervals) and the solution of a number of problems of interval estimation. This is followed by a discussion of normal and normalized distributions in which Pearson's and Fisher's methods for testing the normality of a sample are demonstrated. The

succeeding chapter, given over to the statistical analysis of data under non-normal assumptions, should be of particular interest to those concerned with data which consist of rankings. Chapter IX is a very good discussion of the various kinds of sampling systems and the types of errors that may be encountered in investigation by sample. Chapters X and XI deal with analysis of variance and covariance and the application of these techniques in practical problems. Chapter XII, on the principles of experimentation, is a clear discussion of the self-contained experiment and of the rôle of statistics in the design of experiments. Chapter XIII illustrates the application of principles of experimentation in various kinds of design, and the last chapter carries through the complete analysis of a regression problem and a problem in the use of discriminant function.

Although the major topics are presented in logical order, some questions may be raised about the placement and emphasis of sub-topics. Yates' correction for continuity in connection with chi-square is noted very briefly and the reader is referred to a reference. Since this correction is frequently called for in psychological experiments, it is unfortunate that more space is not devoted to it. On the other hand, three tests of homogeneity of variability are described and illustrated when one method would seem sufficient. Degrees of freedom are mentioned a number of times in the first five chapters but the concept is not explained until the close of Chapter VI. The analysis of covariance is briefly defined and the problem illustrating its application is much too complex to clarify the use of the method. But these criticisms are relatively minor when compared with the general comment that the book is extremely difficult reading. Psychology and education students who have had no more than one year or one course in descriptive statistics will generally find that they are beyond their depth throughout large portions of the text. Calculus is rather infrequently used but there is great stress on the mathematical formulation and development of statistical concepts. The style in many places is similar to that of highly technical journals. In a book of reasonable size, this style is perhaps unavoidable when the presentation has been based on original and secondary sources of mathematical statistics. But it limits the use of the book to those readers who have a solid foundation in mathematics or to those who have had considerable prior statistical training.

It is the reviewer's opinion that *Statistical Methods in Research* will be found most useful as a reference text or as a course text for those with a major interest in statistics. For most graduate students of psychology and education the book would be of very limited value.

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PAUL F. LAZARSFELD, AND FRANK N. STANTON, Editors. *Communications Research* 1948–1949. New York: Harper and Brothers, 1949. pp. 332.

The field of communications research differs in emphasis from educational research in being concerned more with the impact of mass media, such as newspapers and radio, on persons of all ages, especially adults, usually in out-of-school situations. These differences in substance are not intellectually significant, however, and readers of the JOURNAL will find much in this volume that is interesting and provocative.

The eight studies here collected fall into three methodological categories. The first, intensive interview studies, consists of (1) "The Children Talk about Comics" by Katherine M. Wolf and Marjorie Fisk; (2) "Research For Action" (a study of radio's morning audience) by Paul F. Lazarsfeld and Helen Dinerman; (3) "What 'Missing the Newspaper' Means" by Bernard Berelson; (4) "The Analysis of Deviant Cases in Communications Research" by Patricia L. Kendall and Katherine M. Wolf; and (5) "Patterns of Influence: A Study of Interpersonal Influence and of Communications Behavior in a Local Community" by Robert K. Merton. What these studies have in common is a highly insightful, well-nigh clinical, analysis of responses obtained by skilled interviewers from samples of persons chosen because of their special importance to the problem under attack. These studies are rich in *verstehen;* the designs, analyses and interpretations reflect intimate acquaintance with the research area, immersion in the data, and creative imagination in synthesizing hypotheses and conclusions.

For lack of space, we shall exemplify this group of researches only with the study of comics. We are given classifications (1) of comics into 'funny animal,' 'adventure' and 'educational' types, (2) of comic reading into three chronological stages, (3) of functions of comics into the *Alice in Wonderland,* or

variety and action function, the 'batman' function (the invincibility of the vincible); and the *Reader's Digest* function, (4) of readers into fans, moderates, and indifferents or hostiles. Each of these classificatory schemes is exhibited in relation to various others. Psychological ideas are used freely, among these being 'ego-strengthening,' 'projection,' 'identification,' and 'adjustment.'

The recurrence of trichotomies makes us wonder, of course, whether they are intrinsic to the data or merely a Procrustean methodological rut. But the qualitative descriptions of these conceptual schemes and the anecdotal quotations illustrating them do succeed in bringing the discussion to life in a manner seldom seen in research reporting. We hope it was not a necessary concomitant of this liveliness that few of the tables showing relationships are summarized in coefficients of any kind, and no tests of statistical significance are reported. So important a conclusion as the following is buttressed by a single sentence devoid of either a coefficient or a level of confidence: "Cross classification of children by degree of psychological adjustment and degree of interest in comic reading reveals that only one fan is psychotic and a bare handful of fans are normal children. But a marked correlation is revealed between neuroticism and being a fan. Of all the neurotic children, fifty per cent are fans and only thirty-three per cent moderate readers, while for problem children the proportion is exactly reversed, fifty-four per cent being moderate readers and only thirty-two per cent fans." (p. 29)

Somehow we missed these traditional impedimenta of educational research. Perhaps they are absent for the sake of readability. This cavalier approach to statistical description and inference prevails throughout the book. This is hard to understand since other evidences of research integrity and skill are so abundant. Furthermore, in several other places, these papers show much less concern for journalistic vigor. We wish an explanation had been made of this disregard for what so many graduate students have had to learn about statistical methods in research.

The second category of papers, statistical reports, consists of (1) "An Analysis of Radio's Programming" by Kenneth Baker; and (2) "Overlapping Magazine Reading: A New Method of

Determining the Cultural Levels of Magazines" by Babette Kass. The former is a straightforward sampling survey of facts about the programs broadcast by commercial stations during a typical week in 1946. Apart from the facts themselves, this study is noteworthy primarily for the thoroughness and sophistication evident in the description of procedure.

The study of magazine reading is devoted to the development of a coefficient, called 'phi,' of overlapping reading. Phi equals $c/\sqrt{ab}$ where a is the number reading Magazine A, b is the number reading Magazine B, c is the number reading both A and B. Its correlation with impressionistic judgment rankings of magazines is high, the deviations from perfect correlation are analyzed, and limitations of the method are described. Since this phi coefficient correlates so highly with the more easily obtained ratings of magazines by judges, it will probably not be used in practice. Rather than validating phi against impressionistic judgments, we would set up phi as the criterion.

The last study is "Domestic Broadcasting in the U.S.S.R." by Alex Inkeles. Based largely on material in Soviet radio 'trade' journals, this more sociological and politico-economic kind of communications research can furnish perspective for educational and social psychologists interested in comparing relationships between social systems and cultural forces.

All in all, the volume combines extraordinary virtues with defects we might never have noticed had not the general level been so high. Hence, for a change, we find ourselves feeling needs for less facile hypothesizing, for greater integration of typologies and constructs from one study to the next, and for more statistical timidity in drawing conclusions. It is also fair to say that these communications researchers would find much to emulate in the superior attention to previous work and the more adequate presentation of statistical evidence that characterize most research in educational psychology. But as models of research approaches that can fruitfully be transferred to educational problems more traditionally conceived, these studies deserve careful reading by students of educational psychology.

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## PUBLICATIONS RECEIVED

ANNE ANASTASI AND JOHN P. FOLEY, JR. *Differential Psychology.* Revised Edition. New York: The Macmillan Co., 1949, pp. 894. $5.50.

RALPH F. BIRDIE, Director. *The Counseling and Guidance Use of Test Scores.* Minneapolis: University of Minnesota Press, 1949, pp. 34. (paper) $1.00.

HOMER L. J. CARTER AND DOROTHY J. MCGINNIS. *Reading Manual and Workbook.* New York: Prentice-Hall, Inc., 1949, pp. 120. (paper)

ALPHONES CHAPANIS, WENDELL R. GARNER, AND CLIFFORD T. MORGAN. *Applied Experimental Psychology: Human Factors in Engineering Design.* New York: John Wiley and Sons, Inc., 1949, pp. 434. $4.50.

AMY BISHOP CHAPIN AND RUTH LUNDIN. *Your Child's Speech and How To Improve it.* Cleveland: The Press of Western Reserve University, 1949, pp. 30. (paper) $0.75.

*Children Absent from School. A Report and a Program.* New York (136 East 57th Street): Citizens' Committee on Children of New York City, 1949, pp. 112. (paper) $1.00.

LEE J. CRONBACH. *Essentials of Psychological Testing.* New York: Harper and Brothers, 1949, pp. 475. $4.50.

MAURICE R. DAVIE. *Negroes in American Society.* New York: McGraw-Hill Book Co., 1949, pp. 542. $4.50.

PAUL E. FIELDS. *Instructor's Manual To Accompany John Frederick Dashiell's "Fundamentals of General Psychology."* Boston: Houghton Mifflin Co., 1949, pp. 155. (paper) $3.40.

CLIFFORD P. FROEHLICH AND HELEN E. SPIVEY. *Guidance Workers' Preparation.* A Directory of the Guidance Offerings of Colleges and Universities. Washington: U. S. Office of Education, 1949, pp. 45. (paper)

KENNETH G. FULLER. *An Experimental Study of Two Methods of Long Division.* New York: Bureau of Publications, Teachers College, Columbia University, 1949, pp. 76. $2.10.

I. H. GOLDBERGER AND WILLIAM H. BRISTOW, Directors. *Physical Activities for Elementary Schools. A Manual for Physical Activities in the Health Education Program.* New York:

Board of Education of the City of New York, 1949, pp. 242. (paper)

FLORENCE L. GOODENOUGH. *Mental Testing: Its History, Principles, and Applications.* New York: Rinehart & Co., Inc., 1949, pp. 609. $5.00.

SUDHIN N. GHOSE. *And Gazelles Leaping.* New York: The Macmillan Co., 1949, pp. 238. $3.50.

ROBERT HOPPOCK. *Group Guidance: Principles, Techniques, and Evaluation.* New York: McGraw-Hill Book Co., 1949, pp. 393. $3.75.

RICHARD H. LAMPKIN. *Variability in Recognizing Scientific Inquiry: An Analysis of High-school Science Textbooks.* New York: Bureau of Publications, Teachers College, Columbia University, 1949, pp. 79. $2.10.

MERLE LAWRENCE. *Studies in Human Behavior.* Princeton, N. J.: Princeton University Press, 1949, pp. 184. (paper) $3.50.

THURBER H. MADISON, DOROTHY G. KELLEY, AND WILLIAM H. FOX. *Music in the Elementary Schools of Indiana.* Bloomington, Ind.: Indiana University, 1949, pp. 63. (paper) $0.75.

MARGARET MEAD. *Male and Female: A Study of the Sexes in a Changing World.* New York: William Morrow & Co., Inc., 1949, pp. 477. $5.00.

FREDERICK MOSTELLER, HERBERT HYMAN, PHILIP J. MCCARTHY, ELI S. MARKS, AND DAVID B. TRUMAN. *The Pre-election Polls of 1948.* Report to the Committee on Analysis of Pre-election Polls and Forecasts. New York: Social Science Research Council, 1949, pp. 396. (paper) $2.50.

LAWRENCE I. O'KELLY. *Introduction to Psychopathology.* New York: Prentice-Hall, Inc., 1949, pp. 736. $4.50.

MURIEL CATHERINE POTTER. *Perception of Symbol Orientation and Early Reading Success.* New York: Bureau of Publications, Teachers College, Columbia University, 1949, pp. 69. $2.10.

STAFF OF THE READING CLINICS OF THE UNIVERSITY OF CHICAGO. *Clinical Studies in Reading. I.* Chicago: The University of Chicago Press, 1949, pp. 173. (paper) $3.50.

WILLARD L. VALENTINE AND DELOS D. WICKENS. *Experimental Foundations of General Psychology.* New York: Rinehart & Co., Inc., 1949, pp. 472. $3.00.

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J. E. Wallace Wallin. *Children with Mental and Physical Handicaps.* New York: Prentice-Hall, Inc., 1949, pp. 549. $5.00.

Ellis Weitzman and Walter J. McNamara. *Constructing Classroom Examinations: A Guide for Teachers.* Chicago: Science Research Associates, 1949, pp. 153. $3.00.

Ernest Glen Wever. *Theory of Hearing.* New York: John Wiley and Sons, Inc., 1949, pp. 484. $6.00.

Alfred North Whitehead. *The Aims of Education.* New York: New American Library (245 5th Ave.), 1949, pp. 166. (paper) $0.35.

Mary Hayden Bowen Wollner. *Children's Voluntary Reading as an Expression of Individuality.* New York: Bureau of Publications, Teachers College, Columbia University, 1949, pp. 117. $2.35.

Arthur Wormhoudt. *The Demon Lover: A Psychoanalytical Approach to Literature.* New York: The Exposition Press, 1949, pp. 150. $3.50.

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